AGRICULTURAL

IN THIS ISSUE:

JULY, 1959

If "bloom" and "creaming-rate" tests told the whole emulsifier story, formulating liquid concentrates would be comparatively simple. But they fail to measure the storage stability of emulsifiable concentrates under the hot Texas or California sun.

That's why Witco builds unsurpassed storage stability right into its Emulsol EMCOL H-300X and H-500X emulsifiers. These two outstanding emulsifiers are balanced for wide range function...have ten or twelve components specially designed to give your concentrates top-notch emulsification under difficult field conditions.

EMCOLS H-300X and H-500X can be used in low concentrations to give you quality products at competitive prices. Put them through their paces in your own laboratory rapid-aging tests. For the performance you want at the price you want...EMCOLS H-300X and H-500X.

WITCO CHEMICAL COMPANY, Inc. *Emulsol*

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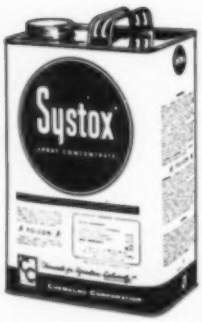
Chicago • Boston • Akron • Atlanta • Houston • Los Angeles • San Francisco
Toronto and Montreal, Canada (P. N. Soden & Co. Ltd.)



SYSTOX Spray Concentrate. The original systemic insecticide for control of aphids, mites and leafhoppers on a wide variety of crops.

DYLOX 50% Soluble Powder. A highly effective control for a variety of insects on alfalfa, cabbage, cotton and sugar beets.

CO-RAL 25% Wettable Powder. A revolutionary spray control for cattle grubs, screwworms, lice, ticks and horn flies on livestock.

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CO-RAL Livestock Duster. A .5% dust in a pocket-size squeeze bottle for the spot treatment of screw-worms and ear ticks on livestock.

DYRENE 50% Wettable Powder. An outstanding foliage fungicide for fungus disease control on tomatoes, potatoes and celery.

Manufacturer of

"Chemicals for Agriculture—Exclusively!"

DEF Cotton Defoliant. Revolutionary action produces better than 90% defoliation in as little as 5 to 7 days.

HERBICIDES. A wide variety of formulations for eradicating all common types of brush and weeds in all major crops.

PARATHION. Ethyl parathion 98.5% or methyl parathion 80%. High quality technical parathions for manufacturing purposes.

GUTHION 25% Wettable Powder or Spray Concentrate. For the control of virtually all major insects on cotton and deciduous fruit.

This Month's Cover

J. D. Stewart, Jr., newly elected president of the National Plant Food Institute. Mr. Stewart is president of Federal Chemical Co., Louisville, Ky. Story on page 28.

Vol. 14, No. 7 July, 1959

AGRICULTURAL Chemicals

ARTICLES

FEATURES

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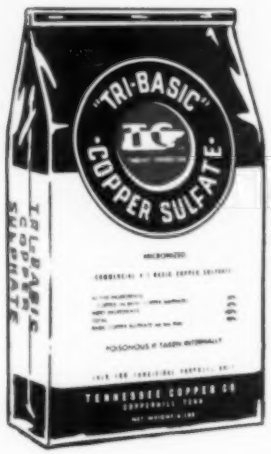
The Versatile Fungicide



You get so many more advantages with Copper fungicides — used as a spray or dust on practically all truck crops in the control of persistent fungus diseases — Tri-Basic provides control of citrus and grape diseases, also on many deciduous fruits — Tri-Basic has excellent adherence qualities and protects longer — lower disease control cost, greater yield of top quality produce.

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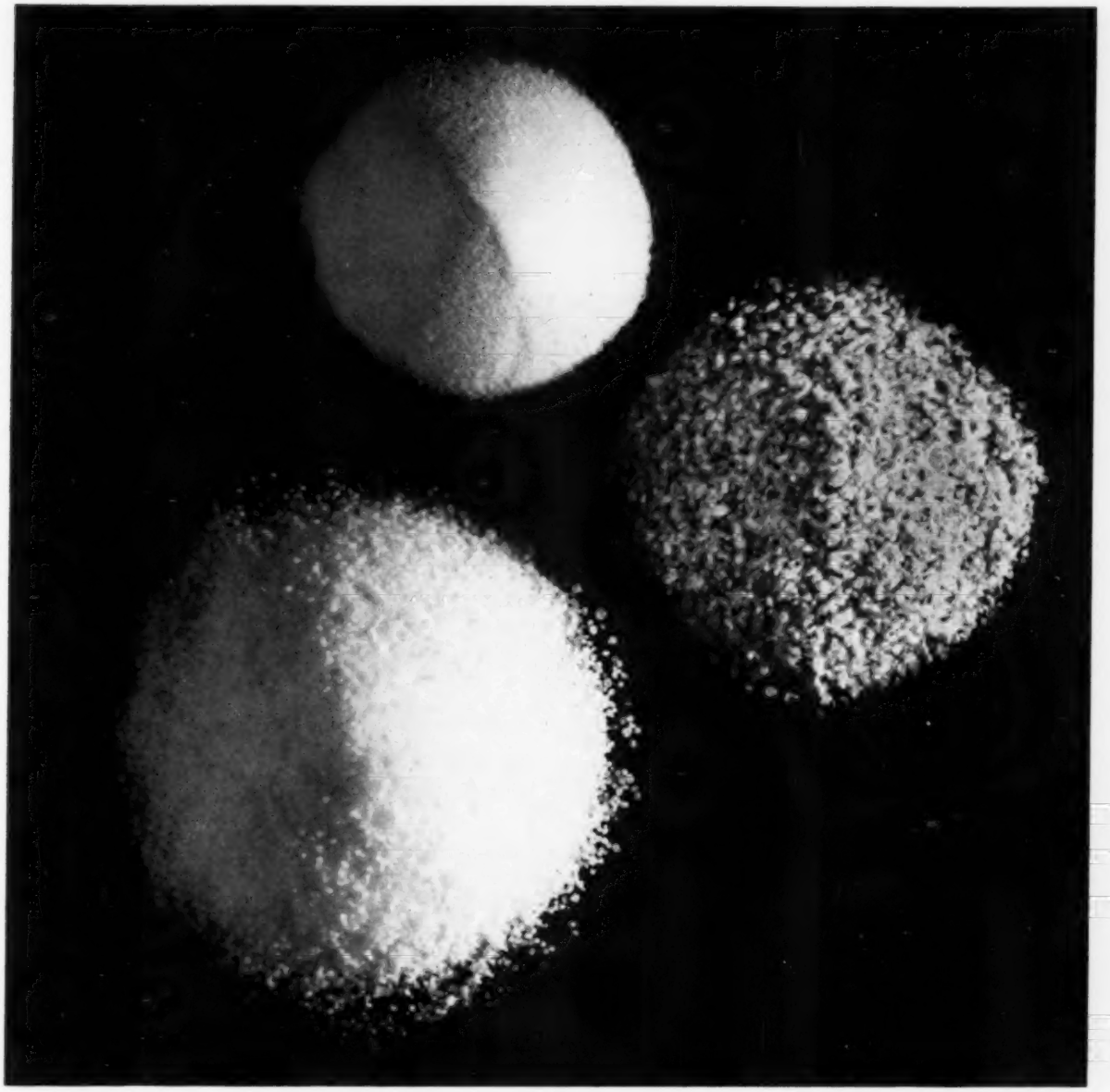

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To help you make better fertilizers, USP offers *three* outstanding grades of muriate of potash—each ideally sized to meet current fertilizer manufacturing requirements. Two white grades—Higrade muriate and Higrade Granular muriate—each contains 62/63% K_2O, and each gives the most potash per ton for mixed fertilizers. And USP's Granular muriate, containing 60% K_2O, is ideal for fertilizers requiring a still larger particle size. All three grades are specially refined to resist caking and remain free-flowing throughout.

For complete technical data and shipping information, contact the United States Potash Company. Our expertly staffed Technical Service Department welcomes your inquiries.

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INTERNATIONAL'S service concept helps you sell more fertilizer... profitably!

International's exclusive Full Orbit Service program is helping hundreds of fertilizer manufacturers turn better profits — through impoved business techniques.

Planned as a market-building program which rests on the use of professional management methods by fertilizer manufacturers, Full Orbit Service is put into effect by individual International salesmen.

Drawing on the talents of experts in many fields, your International salesman becomes the route to manufacturing and merchandising success for companies not needing the full-time services of highly skilled specialists.

How does it work? The Full Orbit program is a free service of the International Minerals & Chemical Corporation. Customers of International who have problems in Sales Management, Transportation, Manufacturing, Credit and Collection, Insurance, or Advertising are invited to discuss opportunities for improvement with their International representative.

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Why International? The project was approached much as you would do it. It was based *not* on the belief that we are "smarter" than anyone else . . . but on the conviction that it *is* a responsibility of IMC to help keep the fertilizer industry healthy, growing and profitable.

Working together for mutual gain is, then, the reason behind Full Orbit Service. The ideas and materials available through this program are ready to help you to improved business methods. Discuss your needs with your IMC man. He'll be glad to bring you new thoughts, new techniques, new stimulation for better operation.

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29-59

MARKET REPORT

Nitrogen Market Nervous

The latest semi-annual survey of the international nitrogen situation by Aikman (London) Ltd., indicates that the low prices now in effect reflect a state of nervousness about the future which Aikman itself doesn't share. World supplies are below what Aikman previously had predicted and the supply and demand position, they believe, is perfectly satisfactory at present.

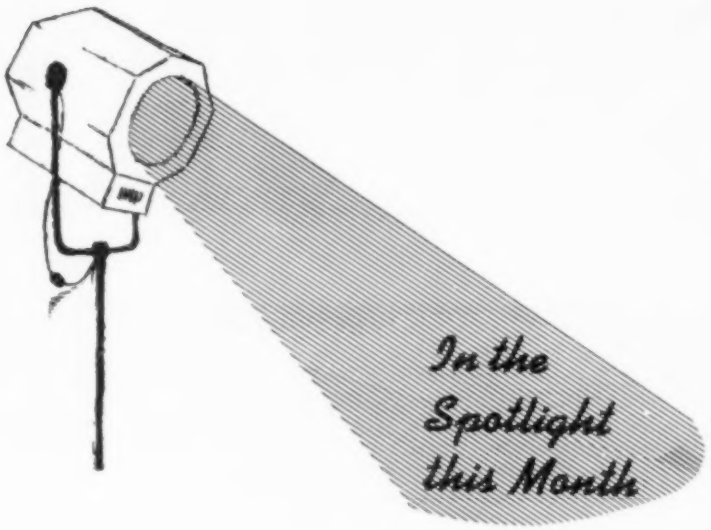
In spite of this, the world nitrogen markets have sagged. For example: sales of ammonium sulfate were made to Spain at $40.47 per ton in December, and then dropped to $37 in April. In Greece last season, bagged ammonium sulfate was sold at $46.25 c.i.f., but in February of this year, business was conducted at $42.40.

In Ireland, the price has completely collapsed, and sales have been made on the basis of "ship first and meet the lowest price afterwards."

Imperial Chemical Industries (England) has announced that, from July 1, the price of sulfate of ammonia manufactured by members of the British Sulphate of Ammonia Federation has been reduced. The price per ton, before deduction of the fertilizer subsidy is £19 17s, or 11s lower than last July, yet the guaranteed nitrogen content of sulfate of ammonia has been increased from 20.8 per cent to 21 per cent.

The Aikman report said, however, that when a little confidence is restored, prices might rebound quickly, although they may, in the immediate future, go a little lower before this happens. Analyzing the situation, Aikman notes that competitive sales of calcium ammonium nitrate and ammonium sulfate nitrate from European producers have undoubtedly caused the lowering of prices for these products

(Continued on Page 82)



- **Mixed Liquid Fertilizer . . .** Several means of using wet process phosphoric acid were discussed at the Liquid Fertilizer Conference at TVA. In one case, impurities in the acid are kept in suspension by use of colloidal clays; in another, the wet acid is concentrated to obtain self sequestering properties; superphosphoric acid as the sequestering material in wet process acid is still a third way of using this acid in liquid fertilizers. Page 24.

- **Pesticide Sales Aids . . .** A complete refresher course has been put together by a pesticide manufacturer, reviewing such information as insect identification, insecticide formulations and their uses, how to apply insecticides, insect control arithmetic, how to display insecticides, and hints for more sales. Page 36.

- **Nitrogen Solutions . . .** Fixed nitrogen content; fixed to free ratio of nitrogen; and water content are three sets of characteristics classifying ammoniating solutions. Page 34.

- **Systemic Pesticides . . .** A fluoro acetamide sold in Japan as "Fussol" is suggested for control of mites, aphids and scales. It is said to have little effect on predators. Page 27.

- **Fertilizer Economics . . .** A little circulated bulletin prepared by the USDA reports on the economic position of fertilizer in the U. S. The authors indicate that average use of fertilizer in 1945 was far below the rate of application that would have been most profitable. The marginal dollar spent on fertilizer brought an increased return in value of crop of $2.93. Page 39.

- **The Agricultural Applicator . . .** Of special interest to custom applicators are features on the toxic effects of pesticides on bees,—a "composite" Stearman airplane,—and a report on the application of dope and fabric to aircraft. Page 55.

Famous Model "AF" Bagpaker® weighs, fills, settles and closes a 100-lb. bag every 2½ seconds!

WITH THIS engineering marvel at his command, the *one man* in our picture can package from 15 to 25 BPM. And he can *instantly* adjust the rate of speed through the machine's variable drive.

The operator simply hangs empty multiwalls on the hopper spouts as the 10-station turret rotates past him. The Model AF Bagpaker takes over from there.

It accurately *weighs* any free-flowing or semi-free-flowing material, quickly *fills* the bag, *settles* it by vibration, automatically *preforms* the top, and *stitches* it tight. You can choose from nine different closures. Bagpak's exclusive "Cushion Stitch," a reinforced two-thread double-lock chain stitch, is standard equipment.

The Model AF Bagpaker is ruggedly constructed of heavy welded steel throughout. Gears are fully enclosed and bathed in oil. Critical parts are of *stainless steel*.

There is a Bagpaker model for every need. They range from the completely automatic Model "A" Bagpaker, capable of packaging up to *60 tons per hour*, to small, manually operated economy models.

Whatever your multiwall packaging needs, it will pay you to talk to your Bagpak sales and service representative.

Bagpak Division **INTERNATIONAL PAPER** New York 17, N. Y.

Trade Listing

National Agricultural Chemicals Association, Association Building, 1145 19th St., N.W., Washington, D. C. Lea Hitchner, exec. sec.

National Plant Food Institute, 1700 K St., N.W., Washington, D. C. Paul Truitt and Russell Coleman, executive vice-presidents.

American Potash Institute, 1102 16th St., N.W., Washington 6, D. C. H. B. Mann, president.

American Society of Agronomy, 2702 Monroe St., Madison, Wisc. L. G. Monthey, executive secretary.

American Phytopathological Society, S. E. A. McCallan, secretary, Boyce Thompson Institute, Yonkers, N. Y.

American Chemical Society, 1155 16th St., N. W., Washington, D. C.

Association of Official Agricultural Chemists, P. O. Box 540, Benjamin Franklin Station, Washington, D. C. William Horwitz, secretary-treasurer.

Agricultural Ammonia Institute, Hotel Claridge, Room 305, Memphis, Tenn. Jack Criswell, executive vice-president.

American Society of Agricultural Enginers, F. B. Lanham, secretary, 505 Pleasant St., St. Joseph, Mo.

Carolinas-Virginia Pesticide Formulators Association, 516 S. Salisbury St., Raleigh, N. C. Hugh Horn, secretary-treasurer.

California Fertilizer Association, Sidney Bierly, executive secretary, Room 213, Ochsner Building, 719 "K" Street, Sacramento, Calif.

Chemical Specialties Manufacturers Association, 50 East 41st St., New York City, Dr. H. W. Hamilton, secretary.

Entomological Society of America, 1530 P. Street N. W., Washington, D. C. R. H. Nelson, secretary.

National Fertilizer Solutions Association, 2217 Tribune Tower, Chicago, Ill. M. F. Collie, secretary.

National Cotton Council, P. O. Box 9905, Memphis, Tenn.

Soil Science Society of America, 2702 Monroe St., Madison, Wisc. L. G. Monthey, exec. sec.

Weed Society of America, W. C. Shaw, secretary, Field Crops Research Branch, Beltsville, Md.

Western Agricultural Chemicals Association, Charles Barnard, executive secretary, 2466 Kenwood Ave., San Jose, Calif.

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The biggest blender ever designed exclusively for dry-mixing botanical pesticides!

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MEETING CALENDAR

July 7-9 — Pacific Northwest Plant Food Assn., Regional Fertilizer Conference, at Tacoma, Wash.

July 9-10 — Alabama Seedsmen's Association, annual convention, Houston Hotel, Dothan, Alabama.

July 15-17—Southwestern Fertilizer & Grade Meeting, Galvez Hotel, Galveston, Tex.

July 29—Kentucky Fertilizer Conference, Guignil Theatre, Univ. Kentucky, Lexington, Ky.

July 31—Agronomy Field Day, University of California, Davis campus, Calif.

Aug. 3-7—Gordon Research Conference on Biochemistry and Agriculture, Kimball Union Academy, Meridian, N. H.

Aug. 9-13—Rocky Mountain Conf. of Entomologists, Cameron Pass 4-H Club Camp, Gould, Colo.

Aug. 18-22—California Fertilizer Assoc., Bigwin Inn Lake, Bays, Ont.

Sept. 20-24—Canadian Agricultural Chemical Assn., Chateau Frontenac, Quebec, Canada.

Sept. 24-25 — Annual Northeastern Fertilizer Conference, National Plant Food Institute, Biltmore Hotel, New York.

Sept. 30-Oct. 1—Southeastern Fertilizer Conference, Biltmore Hotel, Atlanta, Ga.

Oct. 13-14 — Western Agricultural Chemicals Assn., fall meeting, Villa Hotel, San Mateo, Calif.

Oct. 14-16—Pacific Northwest Plant Food Assn., annual convention, Chinook Hotel, Yakima, Wash.

Oct. 15-16—Chemical Control Conference and Fertilizer Control Officials Meeting, Shoreham Hotel, Washington, D. C.

Oct. 19-20—Fertilizer Safety Section, National Safety Conference, LaSalle Hotel, Chicago.

Oct. 21-23—National Agricultural Chemicals Association, 26th Annual Meeting, French Lick-Sheraton Hotel, French Lick, Indiana.

Oct. 27-29—Florida State Horticultural Society, Everglades Hotel, Miami, Fla.

Nov. 4-6—Fertilizer Industry Round Table, Mayflower Hotel, Washington, D. C.

Nov. 2-4—Canadian Manufacturers of Chemical Specialties, second annual meeting, Royal York Hotel, Toronto, Canada.

Nov. 8-10—National Fertilizer Solutions Assn., annual convention, Statler Hilton Hotel, St. Louis, Mo.

Nov. 9-11 — California Fertilizer Assn., 36th Annual Convention, Fairmont Hotel, San Francisco.

Nov. 12-15—Texas Aerial Applicators Association, annual convention, Orange House, Orange, Texas.

Nov. 16-20 — National Aviation Trades Assn., 20th Annual Convention, New Orleans, La.

Nov. 30-Dec. 3—Joint meeting of Entomological Society of Canada and Entomological Society of America, Detroit, Mich.

Nov. 30-Dec. 2 — Soil & Crop Science Soc. of Florida, Gainesville, Fla.

Dec. 7-10—Western Canadian and North Central Weed Control Conferences, Royal Alexandra Hotel, Winnipeg, Manitoba, Canada.

Jan. 6-8—Northeastern Weed Control Conf., 14th annual meeting, Hotel New Yorker, New York.

Count on a Sohio contract to

Figure every nitrogen need in your favor

FIGURING your nitrogen requirements is often the difficult part of planning next year's program. But a Sohio contract ends much of the work and worry.

Sohio technical service personnel will help evaluate your past year's program. They'll help you plan production so you'll parallel industry trends . . . toward higher nitrogen complete fertilizers . . . or the use of supplemental nitrogen materials.

You'll have full flexibility in formulating, too, because Sohio offers a complete line of nitrogen solutions. Sohiogen solutions — containing varying combinations of ammonia, ammonium nitrate and urea — are blended to a wide range of chemical and physical properties. That's why Sohio can suggest the *one best solution* for your entire operation.

Important, too, with your requirements scheduled Sohio can plan production to meet your specific product needs and timetable to serve you even better.

Have the "Man from Sohio" explain how a Sohio contract for the coming year will benefit you by figuring every nitrogen need in your favor.

12-59

See Sohio first for high quality anhydrous ammonia — aqua ammonia — coated 45% or uncoated 46% urea — and 18 nitrogen solutions, including those containing urea.

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Smith-Douglass cuts bag costs with **WONDERWALL**®

Another major user of multiwall bags, the Smith-Douglass Co., Inc., of Norfolk, Va., has reduced bag costs with WONDERWALL, the tougher, cost-cutting new multiwall.

The Company's nine plants are strategically located in the Southeast, Midwest and Southwest, producing substantial quantities of fertilizer, nitrogen and P_2O_5, the latter for use as a phosphorus feed supplement as well as for mixed fertilizer.

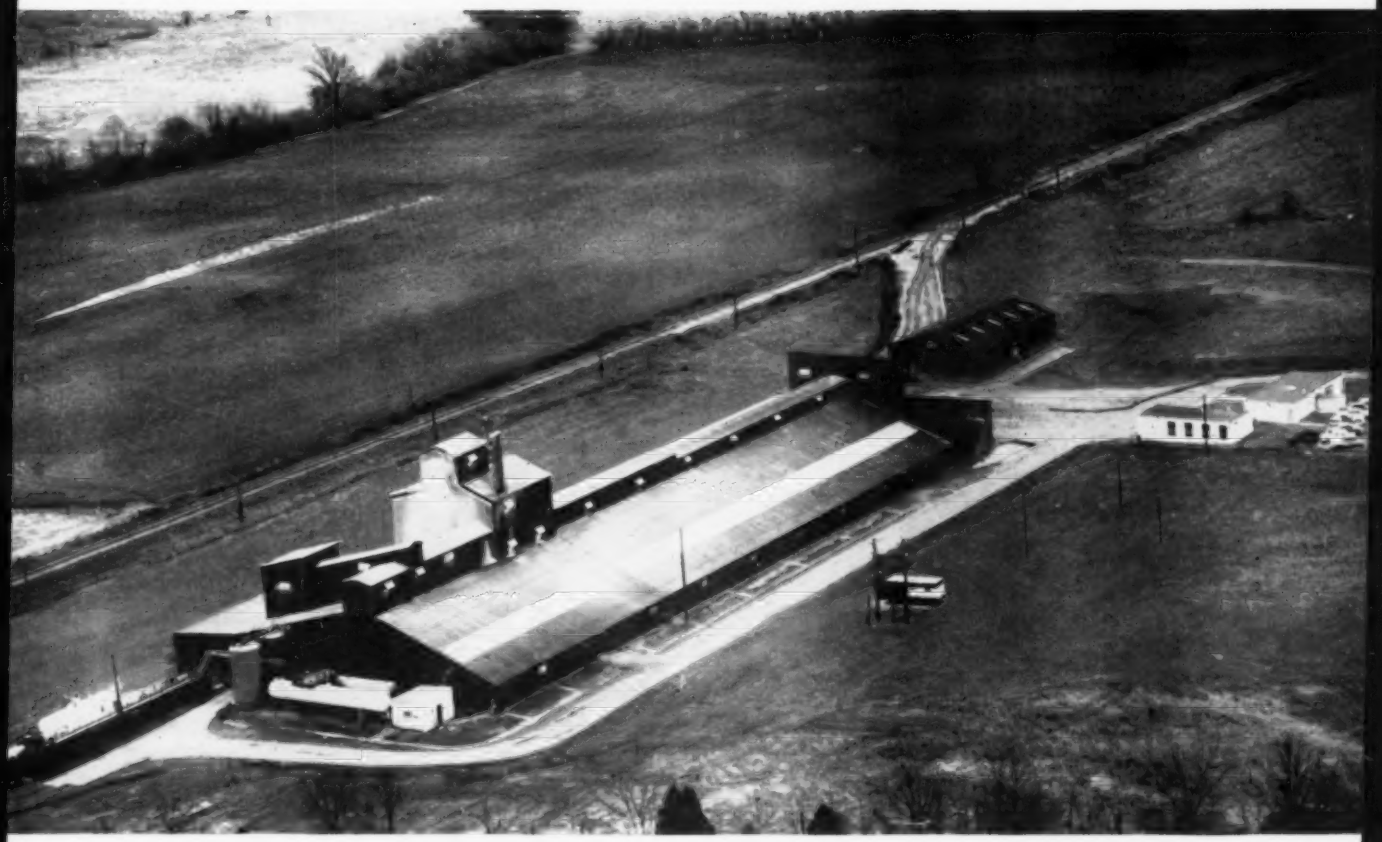
"Because the WONDERWALL is so much tougher," states James A. Monroe, (pictured above) Vice President in charge of Operations, "we were able to lower our multiwall bag paper basis weight by 30 lbs.—from 220# to 190#, and secure a saving of $3.50 per thousand. Breakage was reduced, too."

The WONDERWALL is made with Kraftsman Clupak* paper. Its patented, built-in stretch resists impact and greatly increases toughness.

See how the tougher, stronger WONDERWALL can cut *your* bag costs—and reduce bag breakage, too. Just write Multiwall Bag Division, West Virginia Pulp and Paper Company, 230 Park Avenue, New York 17, N. Y.

**Clupak, Inc.'s trademark for extensible paper, manufactured under its authority.*

West Virginia Pulp and Paper



A NEW PLANT FOR KENTUCKY... A NEW RECORD FOR SACKETT

Here's a brand new granular plant for Kentucky . . . and a remarkable new construction record for The Sackett Company.

Recently completed at Russellville for Cooperative Fertilizer Service of Richmond, this big and fully automated fertilizer manufacturing facility* was built by us in 6 short months.

This is the kind of field performance that Boards of Directors and top management people are looking for . . . the kind they are finding in Sackett . . . *and at the right price, too!*

*Including offices, service buildings, and rail sidings

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America's Foremost Creative Designers and Builders . .

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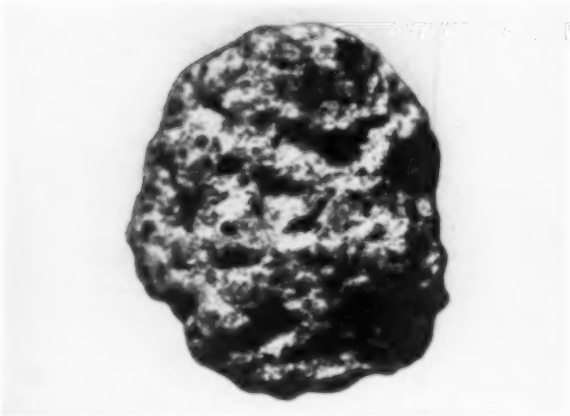
- SUPERPHOSPHATE PLANTS
- RELATED PRODUCTION EQUIPMENT

SEE SACKETT PRODUCTS IN CHEMICAL ENGINEERING CATALOG

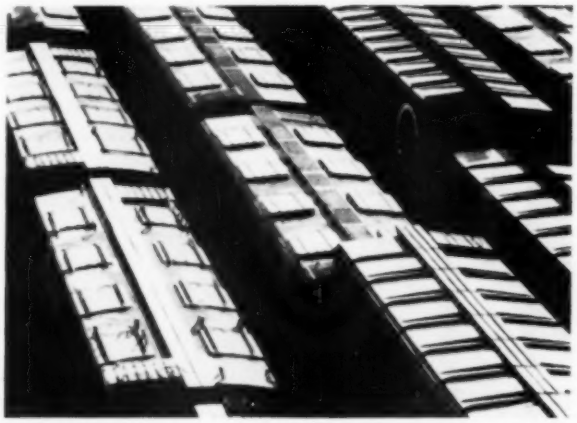
Team up Cyanamid's phosphate products and services for superior mixed fertilizers, economically produced

At Brewster, Florida, Cyanamid mines high grade phosphate rock and manufactures quality TREBO-PHOS* Triple Superphosphate and phosphoric acid.

Add to these fine products Cyanamid's technical and traffic service and you've got an unbeatable combination. Here are a few of the ways Cyanamid helps you manufacture better mixed fertilizers for less money.



Product quality — Porosity of magnified (30x) TREBO-PHOS granule shows why it ammoniates up to 5% without evolution of fumes. Porosity is *controlled;* TREBO-PHOS does not pick up moisture readily, produces a dry, drillable, well-conditioned fertilizer.



Shipping service — Cyanamid traffic experts are experienced at routing phosphate shipments to eliminate avoidable delays. Your plant keeps humming along on schedule. This service is yours when and as you desire it.

Product planning — Cyanamid Technical Service personnel have country-wide experience in formulation and manufacture of mixed fertilizers at lowest cost. Often, what may be new problems for you, are solved problems for them.

Manufacturing assistance — Cyanamid people are versatile. They work where you work, help you get more out of your facilities. Often, they have suggested changes in procedure that have resulted in better mixed goods, produced more economically.

*TRADEMARK

To manufacture fertilizers that sell...
mix with Cyanamid's Phosphates and Service

TREBO-PHOS* TRIPLE SUPERPHOSPHATE | PHOSPHATE ROCK | PHOSPHORIC ACID

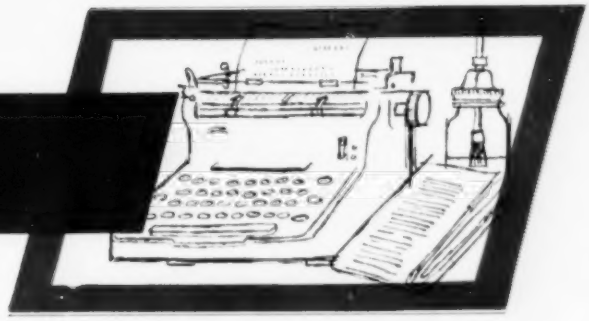
American Cyanamid Company, Phosphates and Nitrogen Department, N. Y. 20, N. Y.

CYANAMID

PHOSPHATE PRODUCTS

AGRICULTURAL CHEMICALS

EDITORIALS



THE current season promises to be the best one in years for sale of both pesticides and fertilizer. Insect infestations have been such a problem in several areas that they have made the headlines, and sales of pesticides are reported at record levels. Fertilizer manufacturers also report a substantial increase in business. Except for the area south of the Great Lakes, where there has been excess rain, early season demand for fertilizer has been heavy, and there are indications that volume for the year could be as much as ten percent ahead of 1958 sales.

One explanation for the increase in fertilizer consumption is the fact that a consistent, intelligent case is being made for use of fertilizers in the booklets and sales promotion material that is being issued. Farmers are getting the message from all directions that the efficient way to raise any crop is to farm intensively, with the heaviest practical fertilizer application on a smaller number of acres. They are being reminded constantly that it is even more profitable to use fertilizer on high-yield land than it is on the less productive acres, for here is where optimum fertilizer applications produce those dramatic increases in yield, and result in the top-record performances. They are being told that fertilizer takes some of the gamble out of farming, because fertilized acres make more efficient use of rainfall than does unfertilized land in those recurrent dry periods.

A number of companies have brought out excellent sales promotion pieces which are helping to build the market for more plant food, — and for increased use of pesticides. A joint industry effort that has been particularly helpful has been the Fertilizer Salesmen's Handbook published by the N.P.F.I. It is a truly fine piece of work, designed to assist not only the fertilizer salesman, but all who have to do with fertilizer use. Every county agent, vo-ag teacher and soil conservation supervisor should have a copy. One nitrogen producer has distributed over 500 copies of the handbook in his home state. If other companies would do as good a job of distribution in their

(*Turn to Page* 82)

* * * * *

OPENING of the St. Lawrence Seaway has revived the threat of dumping of Russian potash on the American market. Such imports as have reached the U. S. from Europe in the past have had to be used on the Eastern seaboard, but the new seaway makes it possible for European shippers to think of tapping our midwestern market.

Up to this point, the threat has been more potential than real, for Russian potash, besides being low in quality (lumpy and caked) has also been priced above the domestic level. But the possibility of barter deals, or simply a willingness to sell below cost to upset an American market makes the threat one which must be guarded against. The best answer to this potential Russian competition was provided by the spokesman for one major American buyer in the fertilizer field who commented "We wouldn't buy Russian potash at any price."

A leading American chemical company recently attracted considerable attention, largely unfavorable, by contracting for delivery of a substantial tonnage of Russian benzene. Sen. Andrew Schoeppel (R. Kan.) criticized such deals in a statement on the Senate floor last month. We are inclined to agree with the Senator that the advantages of bargain hunting in Russia will prove to be largely illusory. We fail to see any sense in helping to create a favorable trade position for a country that misses no opportunity to assure us they are our enemies.

Part I

TVA Demonstration Attracts 400

"TVA's program directed toward improved fertilizers, cheaper for farmers,—is at the same time conducted in the interests of and with the cooperation of industry—not in competition with it", stressed J. H. Walthall, director, TVA division of chemical development, in addressing some 380 industry and government representatives attending the 1959 demonstration of new fertilizer production technology, held June 9-11 at the TVA center in Muscle Shoals, Ala. In pursuance of this policy, he further pointed out that all the technology developed at the TVA center is freely available to industry,—that industry representatives are invited to visit the TVA plants, to examine the experiments in operation, and consult with TVA scientists and engineers. Blueprints and drawings are furnished on request; patents are licensed without royalty.

Arnold L. Jones, member of the TVA board of directors, confirmed Mr. Walthall's remarks regarding TVA purposes and policies, when he welcomed the attending management and technical personnel representing more than 150 fertilizer companies from 35 states Puerto Rico, and several foreign countries.

The 1959 technology meeting featured pilot-plant demonstrations of the production of granular fertilizers;—reviewing,

The nitrogen loss problem

Production of 12-12-12 in continuous ammoniator

Production of high-nitrogen grades such as 20-10-10

Production of granular, no-nitrogen grades

A special feature of the meeting was a liquid fertilizer conference, at which the general status of liquid fertilizer technology was reviewed, and progress reports were presented on current investigations, with particular reference to use of wet phosphoric acid in production of liquid mixed fertilizers. The audience was reminded that much of the work reported on is as yet incomplete, and should not be con-

sidered as ready for use in operating plants.

Liquid Mixed Fertilizer Technology

"THERE are some 300 liquid mix plants in the United States, reported A. V. Slack, Applied Research Branch, TVA, in discussing the status of liquid fertilizers. Annual production of liquids is in the range of 450,000 to 750,000 tons. Estimates made on the basis of raw materials going into liquid mixed fertilizers indicate that 3 to 5 per cent of the mixed fertilizer being produced currently is in liquid form.

"One of the main advantages of the liquid route to fertilizer production is the relatively low investment required for plant equipment," observed Mr. Slack." Elimination of operations such as granulation, curing, fume disposal, and bagging simplifies production considerably. However, many producers have found it necessary to invest heavily in distribution and application equipment in order to sell their product. Thus the total investment can be considerable . . . reportedly over $200,000 in some instances. This problem is minimized as farmers obtain their own application equipment or custom applicators set up to do business in an area."

Raw materials cost, on the other hand, is an important factor. The trend seem to be to use urea-ammonia nitrate solution rather than urea as a means of reducing cost for supplemental nitrogen, even though grade is usually lowered thereby. The main raw material cost problem, however, is in regard to phosphate. The lower cost of wet-process acid in most areas has led to a major effort to finding ways to use it. Various attempts to avoid the problem caused by impurities in wet process acid may be grouped as: (1) purifying the acid, (2) precipitation of impurities, (3) sequestration of impurities, (4) suspension of impurities.

A continuing problem in liquid fertilizer manufacture is the relatively low analysis attainable in liquid mixes as compared with solid mixes. Furthermore, producers are not able to make some of the popular nutrient ratios because of their high acidity. Examples are 1:4:4:, 1:6:6, 1:4:2 and 0:1:1. Such ratios can be made by replacing part or all of the potassium chloride with potassium hydroxide.

Special grades also give trouble in liquid fertilizer production. Tobacco grades, for example, require use of non-chloride potash in the formulation. Potassium hydroxide is useful for this purpose in liquid fertilizers, since it gives higher solubility than does the potassium sulfate ordinarily used in solid fertilizers. Some fertilizers contain insoluble constitutents such as magnesium compounds or water-insoluble nitrogen. The suspension technique has been found useful for preparing such fertilizers in fluid form.

Progress is being made toward solving or minimizing these problems, concluded Mr. Slack, thereby gaining full benefit from the inherent advantages of the liquid form.

Advantages of Liquid Fertilizers

GEORGE Stanford of the Soils and fertilizer Research Branch, TVA, reported on the "Comparative Agronomic Value of Liquid and Solid Fertilizers." He observed that the rapid rate of growth in use of liquid mixed fertilizers has occurred despite only meager evidence as to their performance relative to conventional solid fertilizers. "This situation apparently reflects the general viewpoint that crop responses from liquids and comparable water-soluble solids do not differ appreciably." Comparisons of liquid and solid nitrogen sources, under conditions which minimize losses to the atmosphere, seldom show measurable yield differences; and with respect to potassium, there are no apparent reasons why dissolved and solid salts should differ in effectiveness.

Mr. Stanford reviewed various studies evaluating the phosphorus component of liquid fertilizers as a nutrient source for plants. Greenhouse studies which he described indicate that differences in effectiveness of liquids and solids might be expected on selected solids under field conditions. A Michigan researcher, cited by Mr. Stanford, reported a superiority of band placement of liquids for corn; and a

Nebraska investigator reported a similar superiority for liquids on winter wheat.

"Considering both published and unpublished data," the speaker concluded, "representing 27 field experiments in which liquid and solid fertilizers were compared with the same methods of placement, there have been only three instances in which yields from liquids were significantly greater than from solids, and one instance of greater yield from the solid. In these cases, the differences were small, and were not apparent on the same soil type in two succeeding years.

"Further basic work should be carried out to provide more definite answers regarding the chemical behavior of liquids and solids in relation to soil properties. For the present, it can be concluded that liquid phosphorus sources are at least as effective as any existing solid sources with proper placement. Economics, convenience and factors other than agronomic, therefore, will govern developments in the near future."

Discussing the use of superphosphoric acid in production of liquid fertilizers, M. M. Striplin, Jr., Division of Chemical Development, TVA, observed that phosphoric acid supply is a major problem to the liquid fertilizer industry. The industry, he said, is geared largely to the surplus furnace acid that does not find outlets in detergents and other comparatively high-priced products. The impurities in wet-process acid, (which is less expensive to produce than furnace acid) are troublesome, and this type acid has not been generally accepted for use in liquid fertilizers, although progress is being made in that direction.

Another major problem in liquid fertilizer production is that the grades of solutions which can be made from ordinary phosphoric acid are not as high as those available in solid fertilizers. Also, most minor and secondary elements are quite insoluble in the usual liquid fertilizers.

On the other hand, superphosphoric acid (containing 76% P_2O_5) can be used effectively together with the wet-process acid. Solutions of ammoniated superphosphoric acid contain polyphosphates in addition to the orthophosphate present in liquids from ordinary acid. As a result, it is possible to produce liquid fertilizers of higher analysis, or, conversely, with lower salting out temperatures. Significant amounts of minor elements may be dissolved in liquid fertilizer containing polyphosphates, whereas such is not true in the case of liquids produced from ordinary acid.

When wet-process acid is ammoniated in the presence of superphosphoric acid or ammoniated superphosphoric acid, the polyphosphates serve to sequester the impurities in the wet-process acid. Thus liquid fertilizers free of precipitated solids are obtained.

When ordinary acid (75% H_3PO_4) is ammoniated to produce an essentially neutral solution, liquid of 8-24-0 grade is the most concentrated that will not salt out when stored at 32°F. With superphosphoric acid, a solution of approximately 11-33-0 grade may be produced which will store satisfactorily at 32°F. Other materials such as urea, potassium chloride, and nitrogen solutions may be added during production of the 11-33-0, or later to the cold base solution to give liquid mixes.

"Several thousand tons of superphosphoric acid have been produced by TVA in the last 12 months, and used in the production of solid and liquid fertilizers," reported Mr. Striplin. "Both the acid and the ammoniated material (11-33-0 solution) have been distributed to the fertilizer industry to demonstrate the advantages of these materials and to develop markets for them which it is hoped industry will find sufficiently attractive to justify undertaking production of the acid. Production has been started in Canada, and at least one company has announced plans for production in the United States.

"This is the second season for production of high-analysis liquid fertilizers from superphosphoric acid. Several companies are using the acid either to produce high-anaylsis solutions or as a sequestrant for wet-process acid." Commenting on distribution of the materials, Mr. Striplin advised that TVA offers the acid and the 11-30-0 solution under short form contracts, which limit the amount to 500 tons of each material to a company per fiscal year.

Caustic Potash in Liquid Fertilizers

J. M. Potts, of TVA's Applied Research Branch, participating in the Liquid Fertilizer Conference, observed that increased solubility of liquid fertilizer raw materials has been obtained by substituting superphosphoric acid for orthophosphoric acid. Further increases in solubility he said, may be obtained by substituting potassium hydroxide for potassium chloride. A drawback to the use of potassium hydroxide, he noted, is its relatively high cost. "However, it appears that there may be special situations, especially for crops which need low-chlorine fertilizers, where the use of potassium hydroxide is justified economically. Potassium sulfate, which is commonly used in low-chlorine solid fertilizers, is not sufficiently soluble for use in liquid fertilizers."

Using potassium hydroxide, maximum grades which did not salt out at 32°F were 7-14-14, 6-12-18, 6-12-15, 6-18-18, 5-20-20, 0-23-23 and 0-27-36. Maximum corresponding grades made with potassium chloride are 5-10-10, 3-6-9, and 3-9-9 for ratios of 1:2:2, 1:2:3, and 1:3:3. The saturation temperature of a 5-10-10 grade solution made with half the potash from potassium hydroxide and half from potassium chloride was 7°F. A 5-10-5 grade solution made similarly with one-third of the potash from potassium chloride had a saturation temperature of 0°F.

(*Continued on Page* 91)

Pesticide productions & imports into Japan

AS in most countries, agricultural chemicals in Japan in previous years had been used primarily for pest control on fruit and vegetable crops. With the development of more effective pesticides for specific pests, agricultural chemicals are being used to a greater extent on other crops, including rice—which for many years presented a most serious problem. The agricultural chemicals industry in Japan has grown steadily since World War II, until pesticide sales in 1958 amounted to 47 million dollars (U. S.). Of this amount, about 10 million dollars worth of pesticides were imported, the balance was produced by the 200 agricultural chemicals manufacturers in Japan.

One of the largest of the Japanese agricultural chemicals companies is Sankyo Co., Ltd., in Tokyo. The firm started out in the pharmaceutical trade in 1899 with the distribution of a digestive enzyme. It added the manufacture and distribution of agricultural chemicals with the first production of chloropicrin in Japan in 1921. Since then, it has continued expanding its agricultural chemicals investigations and production, and now owns three plants for manufacturing agricultural chemicals in addition to four plants for pharmaceutical materials. The Sankyo Takamine Laboratories, established in 1935 have about 120 technicians (including chemists, phytopathologists, entomologists, agronomists, horticulturalists, and physicochemists) investigating new products, and evaluating their applications.

One of the materials Sankyo produces (described below,) is a fluoro acetamide, which they sell under the trade name, "Fussol". The product is a systemic insecticide which is absorbed through the stems and leaves of plants, permeating the whole tissue of the plant. In Japan the product is used and recommended for control of mites, aphids and scales, including ruby scale, cottony cushion scale etc. It is said to have little effect on predators.

Toxicological investigations have shown the systemic to be quite dangerous to humans and animals. Compared with parathion, LD_{50} value are as follows:

chemicals	for mouse oral	for mouse hypodermal	for rat oral
monofluoro acetamide	51.5	25	5.75
Parathion	6.15	9.4	3

Sankyo is working on several chemicals as detoxicating agents of Fussol. These include: acetamide, L-crysteine, glycerrhetine, monoacetine, sodium acetate, and glucosamine.

The trade marked product,

(*Continued on Page* 89)

Japanese Imports of Pesticides
(1958)

Pesticides	Quantity	Value
Technical Grade	tons	SCIF
D D T	2.7	1,560
Aldrin	120.1	231,650
Endrin	79.0	602,967
Dieldrin	21.5	79,795
Chlordane	1.5	2,329
Heptachlor	64.0	96,683
Derris	50.0	36,500
Nicotine Extract	4.1	12,022
E P N	203.4	892,002
Diazinon	10.0	52,099
D M C	9.7	69,120
DEP (Dipterex)	50.0	105,000
D N B P	2.5	4,408
D D V P	2.4	17,705
CMP (Phencapton Trithion)	5.7	42,125
Tuzet	30.0	153,900
Triazin	3.8	15,266
Captan	0	0
Metaldehyde	0.2	416
DBCP (Nemagon)	0	0
E D B	11.9kl	13,793
Technical Totals		— 2,430,286
Formulations		
Nicotine Sulfate	203.2	339,525
D-D	19.8	12,500
Tedion	172.5	255,000
Dipterex	0	0
Zineb	22.6	33,700
Captan	23.6	31,500
Maneb	39.9	72,802
Tuzet	30.0	75,000
Wettable Sulfur	115.0	31,703
Thiuram	10.0	15,800
C M U	1.4	8,220
C A T	1.0	5,000
Others	—	238,357
Formulations Total	—	1,119,107
Pesticides for testing		23,635
Total		3,573,028

"Farm income should come from the market— Not the treasury"

Hon. J. L. Whitten (D. Miss.)

"the interest all NPFI members have in common is making a bigger plant-food pie"

E. Bennett, NPFI president

"DESPITE the different needs of NPFI members, there is one dominant interest which *all* members have in common" said retiring president R. E. Bennett, when he welcomed some 1000 fertilizer manufacturers at the annual meeting of the National Plant Food Institute. This interest, he said, is *to make a bigger plant food pie*. "This one objective – the principal objective of the National Plant Food Institute – should be strong enough to bind all members of the fertilizer industry together." The annual convention was held June 14-17 at the Greenbrier Hotel, White Sulphur Springs, W. Va.

"I hope you will excuse me for my apparent enthusiasm for the NPFI, remarked Mr. Bennett. "I have had several officials of companies belonging to our Institute tell me that they feel the money they contribute in dues to the NPFI is better used than some of the money they contribute as grants in various states. They feel that the Institute can spend the money to better advantage and with better results than they can spend the same money." Mr.. Bennett concluded his term of office as president at the 1959 meeting, and was elected Chairman of the Board. The new president of NPFI is J. D. Stewart, Jr., president of Federal Chemical Co., Louisville, Ky.

NPFI On The Move

THE Institute's expanded program, dedicated to "making a bigger plant food pie, – so that each member can enjoy his share of a larger fertilizer market", was reviewed in a panel presentation by several NPFI regional directors. Russell Coleman, NPFI executive vice president moderated at the session, observing, "the manner in which the Institute's expanded program has developed and the results which are beginning to show, should be ample proof of the soundness of this approach."

"Fertilizer use is most areas in the Far West", reported Richard B. Bahme, NPFI Western regional director, "is a relatively recent development. For this reason, Institute members in the West feel that one important objective of the Institute's work in that area should be to create awareness of the importance of fertilizer, and to enhance the prestige of the fertilizer industry. Accordingly, much of our effort has been directed toward bringing a better realization of the advantages derived from commercial fertilizers to farmers, bankers, farm editors, county agents and other agricultural workers."

Among the projects and activities described by Dr. Bahme were: press tours of chemical fertilizer plants; farm advisor technology and industry tours; special fertilizer issues of Western farm papers, presentation of production achievement awards; co-sponsorship of bankers brochures; and co-sponsorship of various conferences. Dr. Bahme's group has also been able to reach broad audiences through local TV programs.

Zenas Beers, Midwest regional director for NPFI reported that "in the Middle West, both the challenge and the oportunity for the fertilizer industry lie in raising

NPFI - works toward bigger market

the sights of farmers, as to what they can do for themselves with fertilizer and good farming methods. In this area of the country substantial fertilizer use is a relatively new development. Modern agricultural technology, plus a changed price relationship between fertilizer and farm products have created a situation under which heavy fertilization can be tremendously profitable to most farmers".

Mr. Beers observed that although most midwestern farmers know something about fertilizer, they do not know the productive capacity of their soil, nor have confidence in their ability to achieve that capacity. NPFI's efforts in this area are therefore to reach these farmers through: newspapers, literature prepared with cooperation of the land-grant colleges, wall charts in farm stores, etc. Mr. Beers also noted, however, that "before farmers will be convinced that they can reach the production capacity of their soils with fertilizer, we must first convince fertilizer salesmen and dealers. —Awareness of opportunity and conviction that it can be reached are the first steps in profit planning for the fertilizer salesman, the dealer, and the fertilizer customer."

The key which will open the door to increased and improved fertilizer use in the South is simply community organization,—observed Samuel L. Tisdale, NPFI's Southeastern regional director. Getting local people to participate in county soil fertility programs is a simple way of impressing people with the increased benefits of using fertilizer. A starting point in this program has been encouraging each farmer to have his soil tested. The success of the overall approach is already evident. In the six-county area in Georgia, where the program was initiated, the tonnage of fertilizer is up 10.1%, 17.5% for plant nutrients, and over 300% for lime. Other states with similar programs underway are North Carolina, South Carolina, Tennessee and Alabama.

"While the county soil projects are conceived and carried out entirely by the local people, the Institue has lent, is now lending, and will continue to lend as much support to these undertakings as our resources will permit," concluded Dr. Tisdale.

Predicting Fertilizer Use

R. A. King, professor of agricultural economics, North Carolina State College, Raleigh, outlined for NPFI members a modern formula for predicting, one year in advance, plant food use in the United States. The method of forecast, developed at the state college, is designed to predict demand for the different major agricultural regions of the country. "In its present stage of development, the equation will not necessarily reflect all the factors that influence fertilizer consumption, particularly in an unusual year", Dr. King conceded. He indicated, however, that with a proper understanding of the limitations of the method developed, it can be helpful to the fertilizer industry in planning its operations. M. S. Williams, NPFI agricultural economist asked assistance from market research personnel of member companies in an effort to further refine the technique.

Earl F. Crouse, president, Farm Business Council, Inc., told the audience that "net farm income in 1959 will be only slightly less favorable than in 1958, and total farm income will be close to the favorable levels of the past year, but costs will be higher. No farm recession is in sight for 1960," he said, adding however that "livestock and poultry producers will be 'hurting' relative to crop producers."

Referring to "our government farm programs and the 10 billion dollar carryover of farm commodities owned, more or less outright, by the government," Mr. Crouse said: "I have no doubt but that farm programs will be modified as city Congressmen gain more and more control over legislation. The subsidies to agriculture have been part of the cost of transforming agriculture from an earth-bound, horse-powered economy to a developing agribusiness economy of automation, machine power, and

At the Convention

Photos, l. to r.: J. C. Totman, Summers Fertilizer Co. and T. Ware, IMC; Mr. & Mrs. G. Garland, Texas Co.; J. C. Mooar, Sturtevant Mill Co.; and D. George, Richmond Guano Co.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chemical fertilizers. With the transition behind us, it seems to me that the need for some of our farm programs may be passing."

Fertilization in the Future

A SPECIAL program "Fertilization in the Future," moderated by W. R. Allstetter, featured three papers which highlighted the role of fertilizer in increasing crop yields. L. D. Baver, director of the Experiment Station, Hawaiian Sugar Planters' Association, discussed the "Scientific Feeding of High Value Crops," pointing out that one of the important factors in Hawaii's high per acre sugar yields has been the intelligent use of fertilizer. He reviewed data showing the trend of fertilizer use in the Islands and its relation to yield. Fertilizer application on the Hawaiian sugar crop averages 850 lbs. of actual plant food per acre, with the result that yields have risen to over five tons of sugar per acre per year (sugar being a 2-year crop).

"There are rather close relationships" Dr. Baver stated, "between plant and soil compositions and fertilizer responses. It is extremely essential to understand both the soil and the plant in the scientific feeding of high-value crops. The data show that the composition of the stalk in nitrogen, phosphorus, potassium and moisture is much more sensitive and reliable than leaf analyses. The age of the plant is an important consideration in interpreting the composition of the cane plant in terms of fertilization requirements.

"Replicated field experiments have indicated a high correlation between the nitrogen content of the stalk at six months of age and the final yield of sugar when the cane is harvested."

J. Fielding Reed, southern manager for the American Potash Institute, described in his address how the farmer can convert low value crops into high value crops through the intelligent use of fertilizer. He emphasized that the modern trend is to grow more crop on fewer acres through use of fertilizer.

The lower value crops, such as pasture and forage, he reminded are normally greatly underfertilized. "Fertilizer usage on these crops can often be profitably doubled," he suggested, "and net returns increased enormously. The story is really a simple one — as yields go up, unit costs of production go down, and profits per acre go up." He cited a number of examples to illustrate his point.

"In South Carolina Cotton Production Contests, for example, farmers producing 296 pounds of cotton per acre applied as plant food 58-65-69 (N-P-K). The gross income was $114 and profits $22 per acre. When plant food applications were 83-102-147 (N-P-K), yields reached 1,214 pounds of cotton; gross income was $463 and profits, $283 per acre. Truly, cotton can be moved from the 'average value' class to the 'high value class.'"

Mr. Reed observed that if cotton farmers were to use recommended plant food levels on the cotton crop, they would be able to grow on ten and a half million acres practically the same amount of cotton they now grow (6 billion lbs.) on seventeen and a half million acres of land. In the process, profits would be upped from the present $10.17 an acre (a total of $179 million) to $46.80 per acre (or $487 million).

Discussing hay and pasture, he reported that of the 30 million acres in hay and pasture in the southeastern states, only about 6 million acres receive any fertilizer, and even on this land far too little plant food is used. If the unfertilized land received even the inadequate fertilizer applications that are now used on the six million acres, he observed, "the fertilizer used would be around 4 million tons, and the increased farm income would be enormous."

In a specific test on yield of Coastal Bermuda grass on fertilized

Photos on opposite page

Hon. J. L. Whitten, U. S. Congress (Miss.); Louis Wilson, NPFI; J. E. Culpepper, Spencer Chemical Co.; B. Cloaninger, Association of American Fertilizer Control Officials.

Standing: Michael, Walter Sr. and Walter Jr. Sackett and J. L. Prosser, all of A. J. Sackett & Sons. Seated: Mrs. W. Sackett, Mrs. J. L. Prosser and Mrs. Sackett, Jr.

L. E. Orth, Sinclair Petrochemicals; W. L. Gorman, Best Fertilizer Co.; A. H. Bowers, Swift & Co.; M. H. McVickar, California Spray Chemical Corp.; A. Taylor, Chemical & Industrial Corp.

L. Gopp, International Minerals & Chemical Corp.; E. E. Crouse, C. D. Liquid Fertilizer Co.; E. Alward, Aylco Liquid Fertilizer Co.; N. C. White, IMC.

Mr. & Mrs. J. Hall, Potash Company of America; E. German, duVal Potash & Sulphur Co.; Mr. & Mrs. V. Rebak, Grace Chemical Div.

C. E. Veth, Sr., Smith Agricultural Chemical Co.; W. Jacobi, Union Bag-Camp Paper Co.; C. Veth, Jr.; D. Gidney, U. S. Potash Co.; W. F. Farley, Smith Agricultural Chemical Co.

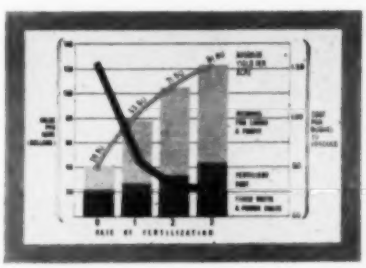
H. H. Shepard, USDA; L. Kaniecki and E. N. Shelton, Tennessee Corp.; W. F. Farley, Smith Agricultural Chemical Co.

W. P. Dean, Swift & Co.; J. P. Porter, Southern Nitrogen Co.; J. Devlin, Southwest Potash Corp.

H. Grady, California Spray Chemical Corp.; S. S. Learned, Phillips Petroleum Co. and J. White, Nitrogen Div.

Mr. & Mrs. R. W. Goldthwaite, Monsanto Chemical Co. and Mr. and Mrs. Steele Wright, Jr., Texas Farm Products Co.

Charts for J. F. Reed's report



land, he reported that production of hay went up from 1.9 to 10.8 tons per acre as fertilizer applications were raised. Percent protein in the hay increased strikingly, and return per acre rose from $40 to $150. Beef production advanced from 269 to 685 lbs. of beef per acre.

A study of wheat production in Ohio, he reported, showed similar proof of the effectiveness of fertilizer in increasing yields and raising profitability of the land. With no fertilizer, the yield was 24 bushels of wheat, with a total value of $48, showing $17.20 profit. With 400 lbs. of 4-16-16 and 30 lbs. of nitrogen, 46 bushels of wheat were produced,—worth $92, and netting a profit of $44.19 per acre.

A demonstration of the value of fertilizing pasture was reported from Wisconsin. "A 14-acre pasture was divided and half of it fertilized. Each side was grazed by dairy cattle. Over a period of 88 days, the total return from the fertilized half was $1,079—from the unfertilized, $482."

While concentrating on the theme that fertilizer can be employed very successfully to convert low value into high value crops, Dr. Reed also recommended that farmers be urged to apply fertilizer generously to land which is already highly productive. Some farmers, he noted, have the feeling that they can skimp with fertilizer on rich, high-yielding land; yet it is on just such land, he reminded, that optimum fertilizer use will give its most dramatic results in the form of record per acre yields.

Hon. J. L. Whitten, U. S. Congress (Miss.); R. E. Bennett, Farm Fertilizers, Inc., and president of NPFI; R. Coleman, executive vice-president of NPFI.

The panel was concluded with a talk by R. J. Hildreth, Texas Agricultural Experiment Station, "Minimizing Weather Risks With Fertilizer." Farmers often restrict fertilizer use, he noted, in the fear that they may not get sufficient moisture during the growing season. "They are not certain of the response they will receive due to weather variations and often do not use the most profitable amount of fertilizer." This weather barrier, he suggested, probably looms much larger to the farmer than the facts justify. Even in low moisture years there is a substantial carry-over of fertilizer to the succeeding crop year, and in any case, fertilized land has shown a demonstrated ability to make more effective use of minimum rain-fall than unfertilized land.

He suggested that if the farmer is unwilling to gamble all-out on what moisture to expect during the growing season, he can still base his fertilizer applications on the amount of soil moisture present at planting time, likening this practice to a "stud poker" game in which he sees his first card before deciding how to bet his hand.

Answering the question as to what sort of research information the farmer needs before he can make intelligent decisions on how much fertilizer to apply in any given season, and how much of this information is now available to aid him, Dr. Hildreth said:

"The first requirement is weather information. This is generally available. The second requirement is information as to the amount of moisture necessary to use most profitably various levels of fertilizer. This latter data will be needed by area, by soil, and by crop. Some data of this sort are available today, though I believe it is safe to say that the surface has just been scratched. The third requirement is simple; i.e., how much moisture is in the ground at the time the fertilizer is applied.

"Once we know (a) the weather probability, (b) most profitable rates of fertilizer at various moisture levels, and (c) how much moisture there is available at the

(*Continued on Page* 81)

Left Photo: J. W. Lewis, F. M. Jornlin, J. O. Ullman, P. B. Turner, all of E. I. du Pont de Nemours & Co.

Center Photo: E. Kapusta, U. S. Potash Co.; H. H. Tucker, Sohio Chemical Co.; H. Riemer, U. S. Borax & Chemical Corp.

Right Photo: G. Klein, Davison Chemical Co.; B. F. Sutherland, Armour Agricultural Chemical Co.; D. Fangmeyer, Northern Chemical Industries, Inc.

A current review of the systemic

Co-Ral for Grub Control

by J. Shaptason
Chemagro Corp.
New York

CATTLEMEN in the United States and Canada have had an opportunity to try Co-Ral, the new sprayable livestock systemic, and to see the results for themselves in their own herds; these results have been excellent. In the feed lots, on farms, and on the range, animals from east to west, north and south have all responded uniformly well to treatments properly applied. Several million head of livestock have been sprayed with Co-Ral during the past use season. Best available information indicates that grub control ranged from 90% to 100% in 99% of all animals treated. Such extensive use of this systemic should indicate that the chemical can do the job.

Several experiments were conducted by Chemagro personnel and State and Federal workers delving into the many questions which had arisen in previous use. Tests were conducted comparing emulsion concentrates and wettable powders. In the final analysis, these two formulations seem to be equivalent in their ability to control grubs. No differences appeared in the control of other insects.

Some trials were conducted into the proper dosage and into the amount of the surface area of the animal requiring treatment for good grub control. The results indicate that backline sprays usually give fairly good control, while near perfect control was obtained from overall coverage. Spraying of the bellyline and short-haired areas alone gave only poor control.

The timing of applications of Co-Ral for the control of cattle grubs is important. If the application is delayed into winter, the hair coat is more difficult to penetrate. There are some indications that in later stages more chemical is required to kill the grub. Early applications will kill the grub before it damages the choice cuts of meat. Another reason for early application is the control of other insects which is obtained as a side benefit. This simple rule is recommended for best grub control: *Apply Co-Ral as soon as possible after the heel fly season is over.*

Dipping cattle in vats charged with Co-Ral is under investigation. Charging a vat with Co-Ral and treating the animals several times during the season for control of all the common insects such as lice, ticks, flies, and screw-worms would enable the cattleman to obtain the maximum benefit for the expenditure he makes in the purchase of the material.

Screw-worm control with Co-Ral sprays has been outstanding. One of the first commercial uses of this systemic was as an aid to the screw-worm eradication program in the southeast. Co-Ral is used routinely to treat livestock crossing Federally designated quarantine lines, guarding the screw-worm free areas. Co-Ral has also been found to be useful in treating the trucks and cattle cars transporting animals in and out of the quarantine area.

Co-Ral has given outstanding control of cattle lice. Even in tests where applications were made in early fall, the animals remained louse-free throughout most of the winter. In commercial use, not a single complaint on louse control has been received.

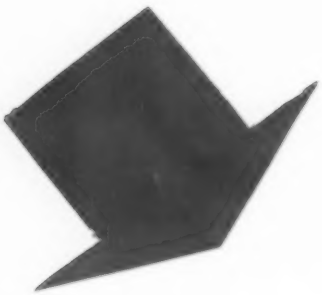
Horn fly control was equally good where sprays were applied early enough to control that insect. Residual control of two to five weeks duration was obtained, depending upon environmental circumstances. Excellent tick control has also been reported from all sources.

In addition to cattle, many sheep and goats were treated with the systemic. On these animals, as in cattle, screw-worm control has been outstanding. The use of Co-Ral against this pest is probably the largest single benefit that the ranchers in the screw-worm area have received. Louse and tick control on sheep and goats has also been excellent.

Co-Ral is not as yet registered for use on poultry or dogs, but experimental work currently underway indicates that the material is capable of controlling all of the major insect and mite pests of poultry. The residue picture is also promising on poultry and an early application for registration for the use of Co-Ral on poultry is anticipated. The demodectic mange affecting dogs and other animals has not been thoroughly evaluated as yet, but early indications are that Co-Ral treatments will succeed where conventional methods fail in giving control.

The future of livestock insect control using sprayed livestock systemics is very promising. Most aggressive cattlemen recognize the cattle grub problem and have attempted to cope with it. However, because of the nature of the insect, an area-wide campaign was necessary to obtain any real benefit. A systemic insecticide is not dependent upon area control. The user obtains the benefit at the time he sprays — not the following year. Properly used, complete control of grubs can be obtained using Co-Ral. The benefits pay for the application.

Note: Next month a second article will deal with spraying techniques for the application of Co-Ral.★★



Basic Principles in Selecting the Correct Nitrogen Solution

TODAY there are in excess of 40 different ammoniating solutions available to the fertilizer industry for the manufacture of mixed fertilizers. As a result of these many solutions, most of which have been introduced during the past three years, the question is often asked, "How does one choose the proper ammoniating solution for his operation?"

It should be realized that there are many different types of fertilizers produced throughout this country today. Fertilizers are produced in mixing plants with various types of manufacturing equipment; batch mixers and continuous ammoniators, some with drying and/or cooling facilities, and many other process variations.

Different fertilizer manufacturers may use different raw materials, which may influence the formulations, such as one or more of ammonium sulphate, anhydrous ammonia, sulfuric acid and/or phosphoric acid. Climatic conditions vary with geographical locations and the season in which fertilizer may be produced.

As a result of these many variables in fertilizer production the nitrogen solution producers have attempted to offer the fertilizer mixers in their marketing area a choice of solutions which will best fit each mixer's individual needs.

The ammoniating solutions available can possibly best be described as having three sets of characteristics which classify them.

1. The first major characteristic is the type and content of the fixed nitrogen, which is usually in the form of ammonium nitrate, urea, or a combination of these two soluble salts.
2. The second characteristic is the fixed-to-free ratio which is the ratio of nitrogen from salts to nitrogen from the free or neutralizing ammonia in the solution. This ratio gives an indication of the soluble salt content and the free ammonia which must be neutralized. The fixed-to-free ratios are usually divided into three groups; low, medium and high. The low group has a fixed-to-free ratio less than 8.0 to 1. The medium group has a fixed-to-free ratio in the range of 0.8 to 1, to 1 to 1, while the high group has a ratio greater than 1 to 1.
3. The third characteristic of a solution is its water content. The water content of a solution can range from as low as 6% in the dehydrated solution to 18% in regular ammonium nitrate solutions and up to 30.7% in the urea solutions.

One additional and very important characteristic, which in some cases must be considered, is the crystallization temperature, or the temperature at which the solution will salt out. This crystallization temperature is, however, dependent upon each of the above mentioned characteristics, type of soluble salt, ratio of soluble salts to ammonia content and per cent water in the solution.

The first step in selecting an ammoniating solution, is to determine which type of ammoniating solution is best for your plant. The ammonia-ammonium nitrate solution, the ammonia-ammonium nitrate-urea solution, or the ammonia-urea solution. All have their own individual properties. In the manufacture of granulated fertilizers, general experience indicates that better granulation of most fertilizer grades can be achieved with the ammonia-ammonium nitrate solution. This is due primarily to the greater solubility of ammonium nitrate, thereby increasing the liquid phase, or the plasticity of the fertilizer in the ammoniator, which is necessary to achieve good granulation.

In the production of non-granular fertilizers, which are low in nitrogen content and high in potash, as are most of the grades in the southeast, an ammonium nitrate solution containing a small percentage of urea, 10 to 15 weight per cent, is used with good success. Twenty to forty pounds of urea in a ton of fertilizer will change the crystal structure of ammonium chloride crystals to give a better conditioned product. However, care should be taken not to exceed 40 pounds of urea in a ton of fertilizer containing ammonium nitrate, as the increased concentration will cause the product to become excessively hydroscopic.

After selecting the type of supplemental nitrogen desired in the ammoniating solution, the next step in the selection is to determine the fixed-to-free nitrogen ratio requirement; low, medium or high ratio. In this selection, consideration must be given to the several following factors:

1. The need for ammonia for heats of reaction and the neutralization of the phosphate materials.

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This is primarily true of the low nitrogen grades.

2. The maximum ammonia that can be reacted with the phosphate materials if sulfuric or phosphoric acid is not used. Care must be exercised not to over-ammoniate the phosphate materials which can lead to phosphate reversion and/or nitrogen losses.
3. In formulations in which sulfuric acid is used, the more ammonia that is present, as in the low fixed-to-free nitrogen solutions, the more sulfuric acid that is required to neutralize the excess free ammonia. This increases the heat developed in the mixer which may be beneficial in low nitrogen grades but can lead to operating difficulties in the higher nitrogen grades. It must be remembered that the increased use of sulfuric acid due to excess ammonia in a solution also increases the cost of the formulation.
4. If anhydrous ammonia is used in the process, a high fixed-to-free ratio is desired, i.e., a solution with the lowest possible ammonia content so that as much low cost anhydrous ammonia can be used in the formulation as possible, thereby reducing the cost of the formulation.
5. In granulation processes the soluble salt required to achieve the proper liquid phase must be taken into consideration. A liquid phase is necessary to give the plasticity which is necessary to get good granulation. Other factors also influence the liquid phase, such as moisture and temperature; however, the soluble salt content, whether ammonium nitrate or urea, is one of the most critical in producing the correct degree of plasticity. The solution with a too low fixed-to-free ratio may result in too little plasticity and will result in insufficient granulation, while a solution with a too high fixed-to-free ratio may give too much plasticity, resulting in large amounts of oversized material being formed in the ammoniator.

After each of the above points is taken into consideration, it will usually be found that a low nitrogen fertilizer grade will require a solution with a low fixed-to-free ratio, a medium nitrogen grade will require a medium fixed-to-free ratio, and the high nitrogen grades, a high fixed-to-free ratio. One exception to this generality is when anhydrous ammonia is used to supplement the nitrogen solution, in which case a solution with a high fixed-to-free ratio is the most desirable.

The third step in the selection of a nitrogen solution is the water content of the solution. In recent years a large number of dehydrated solutions has been introduced to the market which have a moisture content in the 6 to 7 per cent range. The dehydrated solutions have definite advantage in the granulation of the higher nitrogen grade which may tend to overgranulate in that they reduce the amount of recycle required to control the liquid phase in the ammoniator. Another important factor is that fertilizer made with dehydrated solutions require less drying, as the fertilizer comes from the ammoniator with a lower moisture content. The dehydrated or concentrated solutions also have the advantage in freight savings in that the mixer receives more nitrogen per freight dollar due to the lower water content.

In some grades the solution with higher water content is desired to give the required moisture for the proper liquid phase. Also this type of solution is desired in some batch type operations as the dehydrated solutions may produce too much heat, resulting in nitrogen losses, while the increased water in the regular solutions serves to cool the batch as the water is evaporated by the heats of reaction.

If the mixing operations are to be conducted in cool or cold climatic conditions, consideration must also be given to the maximum crystallization temperature allowable. The crystallization temperatures of the many solutions offered vary over a very wide range —from minus 50° F. to above plus 50°F. Many of the popular solutions have crystallization temperatures in the 10° to 30° F. range, which can be particularly troublesome in cold weather operation and should be avoided during the cold seasons unless proper facilities for handling these solutions are installed. The facilities required are insulated and/or heated solution lines and heated storage facilities.

After all these factors have been taken into consideration, several compromises probably will have to be made before selecting the one ammoniating solution which will give you the best product at the desirable operating conditions at the most economical formulation cost. Since it is impractical to use a different solution for each grade produced, the solution selected should be one that most nearly fits the majority of requirements for the majority of the tonnage to be produced. It may be that over the full year's operation, a fertilizer mixer may wish to settle on the use of two ammoniating solutions, a warm weather solution and a cold weather solution.

**This discussion on selection of the correct nitrogen solution for the manufacture of fertilizers was presented at the Fertilizer Industry Round Table, November, 1958, in Washington, D. C.*

Pesticide Refresher Course Offered by Velsicol Corp. to Farm Supply Dealers

A REFRESHER course for pesticide salesmen, prepared by the Velsicol Chemical Corp., Chicago, offers farm supply dealers and their staffs a comprehensive coverage of the subject from the formulation of insecticides through their display and sale and on to their application on crops.

The course is designed to help salesmen talk intelligently to farmers and should be a useful companion piece to the "Fertilizer Salesman's Handbook," issued earlier this year by the National Plant Food Institute. Although the name of the course is "Heptachlor Salesmen's Insect Control Refresher Course," the text does not dwell exclusively on Heptachlor and no attempt is made to compare the merit of individual insecticides. Rather, it explains them.

Divided into nine specific subjects, the course covers: types of insecticides and their uses; insecticide formulations and their uses; insect control arithmetic; how to apply liquid insecticides; how to apply dry insecticide formulations; insect identification; safety in using insecticides how to display insecticides; and helpful hints for more sales.

The first lesson, Types of Insecticides and their Uses, describes three major classifications of insecticides (stomach insecticides, contact insecticides, and fumigants) and lists the applications for which each type pesticide is recommended. All of these insecticides, the course points out, have a place in modern agriculture, but each type also has limitations that prevent it from being used for control of all insects on all crops.

Stomach insecticides are used primarily to control chewing insects on fruit or foilage. Their utility is limited by their efficiency, and their toxicity to humans and plants. Systemics are primarily stomach insecticides, but a few, like Demeton, are also effective as contact insecticides.

Contact insecticides are generally safer, easier to apply, and more versatile than stomach insecticides or fumigants, and they control both chewing and sucking insects. The course sub-divides contact insecticides into plant-derived organic compounds and synthetic organic compounds. The most widely used plant-derived compounds listed are pyrethrum, rotenone, ryania, and nicotine. The synthetic, or "man-made" insecticides include numerous chlorinated hydrocarbons and organic phosphates.

Fumigants, the refresher course points out, are used to control both sucking and chewing insects, and also are effective for nematode control. Generally, however, they should be applied only by personnel who are thoroughly trained in their use.

Seven basic types of formulations are discussed in lesson 2, Insecticide Formulations and their Uses. They are; emulsifiable concentrates, granules, dusts, wettable powders, insecticide-fertilizer mixtures, oil solution,s and aerosols. Differences in strengths of formulations also are discussed. State insect control recommendations for the control of specific insects on specific crops usually include; the types of formulations to use, the amount of technical insecticide that must be applied per acre, and the strengths of the different formulations that can be used. In helping customers choose the type and strength of formulation to use, salesmen are advised always to recommend the highest strength of any given formulation that has official approval. In the long run, the text explains, this will save the customer time and money. For example, if a user can apply 10 pounds per acre of a five per cent granular insecticide, he will have to do less refilling of his applicating equipment than he would if he applied 20 pounds per acre of a 2½ per cent granular insecticide. The course reminds, however, that lower concentrations will give better distribution of the insecticide.

Subject 3, Insect Control Arithmetic, delves into the problem of determining the correct amount of insecticide to use for any given situation. Printed on two sides of an 8½ by 11 inch sheet of paper are tables and formulas that can be kept on hand by salesmen for this purpose.

The methods for applying insecticides are divided into two separate lessons. Lesson 4 covers liquids and lesson 5 covers dry insecticides. Besides describing the types of spray equipment, the fourth course goes into detail on the subject of calibrating field spraying equipment for broadcast spraying, for row crop spraying, and for band spraying. Here, also, tables are printed that can be used by salesmen for reference. Spray equipment, it is recommended, should be calibrated at least once a year, because the rate of application can be increased considerably by nozzle wear. Application rate is determined by speed, pressure, nozzle opening, nozzle spacing, and the viscosity of the liquid that is being sprayed.

Applying the right amount of insecticide dusts or granulates, as

pointed out in lesson 5, generally is easier than applying the right amount of sprays. The reason is that one step is eliminated. Dry materials are used "as is," without dilution or mixing. Most dusting and granular application equipment has metering devices that permit the rate of application to be pre-set, and labels of dry material always give the percent of actual insecticide that the formulation contains. Thus, by referring to a chart contained in lesson 3, a dealer can determine quickly how much formulated dust or granular material must be applied per acre to get the recommended dosage of actual insecticide. Lesson 5 deals with adjusting the equipment to control the rate of application. In addition, the various types of application equipment are discussed.

A basic lesson on insect identification (No. 6) points out that the more the pesticide salesman knows about the appearance, life habits, and damage of insects in his area, the easier it is to sell the chemicals that kill them. Insect life cycles are described, and a chart illustrates some of the more common insect pests. Salesmen are advised to gather basic information about the insects that attack major crops in their area. This knowledge can help customers grow better crops and can help the salesman increase his sales.

Safety in using insecticides is stressed in the refresher course. An entire lesson (subject 7) is devoted to safety. It discusses the differences in toxicity of various insecticides, protective clothing and equipment, and injury to crops and livestock from some insecticides.

The proper display of insecticides receives attention in lesson 8. Outside influences that help condition the farmer to buy insecticides are discussed. Among those mentioned are: farm magazines and newspapers, radio and television, and recommendations of county agents. Farm meetings also exert an influence, as do U.S.D.A. and state extension service bulletins

that tell how, why, and when to use insecticides. The advertising of chemical manufacturers, formulators, and dealers puts the farmer in a buying frame of mind. The answer to whether or not he will buy, however, in many instances, the dealer is reminded, depends on what he sees when he visits his dealer. If he finds an effective display of the materials he had heard about, chances of a sale are good. If he doesn't see a display, he may try down the road, rather than ask questions.

Citing as an example the fact that corn borers infested 88 per cent of the Iowa corn crop in 1957, but only 7 per cent of farmers applied insecticides to control them, the course states that farmers have a tendency to "put up" with insects. It is up to the salesman to get the farmers to stop regarding insects as a natural hazard. To do this, and to show farmers that the good things they have been hearing about insect control are true, the Velsicol course declares, display material must start to work the minute a customer drives up to the store. The first step, therefore, is an effective window display.

Inside the store, display material should guide the customer to product counters. Depending on the size and layout of the store, this may be accomplished with a selection of streamers, mobiles, banners, and signs, or it may take just one or two streamers placed so that customers can't miss seeing them when entering, leaving, or visiting the store.

The displaying of insecticides in more than one place in a store is recommended. In addition to a complete-line display, small spot displays of insecticides throughout the store should not only increase insecticide sales but sales of related items as well.

Timing is important in displaying insecticides. Although most insecticides are sold between late winter and early fall, there are usually periods of peak demand that arise when certain insects are most damaging to particular crops. There also are periods during which certain insects can be controlled most easily, even though they have not reached a damaging stage of growth. A salesman who knows when these periods occur in his area can plan all-out displays to coincide with peak demand and can plan effective long-term displays for the balance of the selling season.

The final lesson (subject 9) of the course contains helpful hints for increasing insecticide sales and tells what can be done with the information offered in the first eight lessons. Once a salesman has convinced his customers that they have insect control problems, he must be able to tell them what insecticides to use and how to use them.

Hints offered to increase sales include: test plots, on-the-farm selling, cooperation with custom applicator, and the proper handling of complaints.

Farmers who have never used insecticides might be persuaded to

(Continued on Page 83)

Synergized Pyrethrum for Protection of Stored Grain

CHANGES in grain handling and storage practices in the past few years have resulted in the storage of grain for much longer periods of time, sometimes up to five years. The reserve stocks of grain accumulated as a result of increased yields and the price support programs have required new and improved methods of insect control. Emphasis is now being placed on preventive rather than curative measures.

A series of tests were conducted on wheat and shelled corn stored on Commodity Credit Corporation, USDA, bin sites, using various formulations of pyrethrins and a synergist. The pyrethrins content of these formulations ranged from .89 to 2.50 ppm, with the synergist usually in the ratio of 1 to 10. Tests were also made at the ratio of 1 to 5, with the synergist alone, and with pyrethrins alone.

Protective sprays and dusts applied at rates of 1.5 ppm or higher of pyrethrins were highly effective in controlling infestations and in preventing re-infestation through two full summer seasons.

The residues as determined by chemical analysis were highest at the first reading after treatment, then fell sharply, leveled off at a low point, but persisted for periods up to two years. Bioassay tests showed the same trend and, after the first month, low mortalities indicated that the residue was below the toxic level. However, the protection given the grain in the bins showed that there was a mass-repellent effect, lasting a long time.

In the tests on wheat, there was no change in the commercial grade throughout the observation period. In the series of tests on corn, with synergized pyrethrins on a talc carrier, the corn was downgraded, because the talc imparted a gritty feel to it.

A total of 13 species of stored grain insects was found in the wheat, and a total of 19 species in the corn. The flat grain beetle, saw-toothed grain beetle, red flour beetle, and dermestids were the most abundant species observed during the study.

Three organic carriers or diluents were used in the protective dusts as substitutes for a commonly used inorganic diluent, talc. These were corncob flour, ground rice hulls and pulverized wheat.

Two types of protective sprays were used. One was made from an emulsifiable concentrate of pyrethrum, or synergized pyrethrum diluted with water; the other was a solution of synergized pyrethrum dissolved in a chlorinated hydrocarbon.

The synergists tested were: piperonyl butoxide, MGK-264 [N-(2-ethylhexyl) bicyclo (2.2.1)-5-heptene-2,3,dicarboximide], and sulfoxide (n-octyl sulfoxide of isosafrole).

This review is just a brief abstract of Marketing Research Report No. 322, issued by the USDA, ARS, under the title, "Evaluation of Synergized Pyrethrum for the protection of Stored Wheat and Shelled Corn from Insect Attack". The work with pyrethrum protective treatments by the USDA is still in progress.

C. C. Alexander Memorial Scholarship at Purdue

C. C. Alexander

Geigy Agricultural Chemicals, Geigy Chemical Corp., Ardsley, N. Y., has announced the establishment of a C. C. Alexander Memorial Scholarship Fund at Purdue University. Mr. Alexander, who died in an airplane accident on May 12, 1959, was research director of Geigy. He was an alumnus of the Purdue Entomology Department, Class of 1938.

The scholarship is the first of its kind at Purdue which will give preference to entomology students. Geigy has made a major contribution to the fund, in recognition of Mr. Alexander's years of service to the company, and for his contributions to the field of agriculture as well as to mark their high esteem for him as an individual.

Contributions may be made directly to the C. C. Alexander Memorial Scholarship Fund, Purdue Alumini Scholarship Foundation, Lafayette, Indiana.

Bibliography

C. C. Alexander, or "Alex" as he was known to his many friends and colleagues, was one of the outstanding men in the chemical industry in the field of research and development of agricultural chemicals. He was active in the Entomological Society of America, having been chairman of the Eastern Branch; he was also chairman of the DDT Committee of the NACA, and active on numerous other technical committees.

C. C. Alexander was born December 3, 1912 in Lykens, Ohio. He graduated from Purdue University in 1938 with a B.S. in Agriculture and a major in Entomology. He received a Master of Science degree from Ohio State Univ.

A Letter to Agricultural Chemicals

I would like to call to your attention several facts about the Alexander Scholarship, which I hope you will publicize in your magazine.

As an outstanding entomologist, Alex did a great deal of the fundamental work on development of DDT formulations. He was known and admired by all of his commercial and professional entomological colleagues throughout the industry. The scholarship will be the first one established at Purdue for the sole purpose of furthering a perpetual entomological scholarship, and it is a fitting tribute to his friends that Alex can be so honored.

As a friend of Alex's and as a worker with him for these many years, I would be very much interested in having this letter given as much publicity as possible so that his friends can join in this tribute to him.

Melvin Goldberg
New York City

FERTILIZER

its economic use in the U. S.
its role in increasing corn yields

A REVIEW of levels of fertilizer use by American farmers and some of the principal factors that determine the economic efficiency of varying rates of fertilizer application is contained in a 32-page booklet issued recently by the Agricultural Research Service of the U. S. Dept. of Agriculture. Titled "The Economic Position of Fertilizer Use in the United States" it was released as Agricultural Information Bulletin No. 202. The report presents: (1) an evaluation of current fertilizer practices in the United States; (2) output at different fertilizer levels compared with projected needs; (3) alternative acreage-fertilizer combinations at which projected needs could be obtained; (4) examples of use of fertilizer to minimize unit costs; and (5) illustrations of optimum use of limited quantities of fertilizer.

While fertilizer use has been increasing sharply over recent years, most farmers, it is emphasized, are still not employing fertilizer at rates as high as those that have been demonstrated to be efficient and economical. Use of fertilizer has increased most rapidly in the Corn Belt, the Lake States, the Great Plains and the Far West. For the 1935-39 period, less than 15% of the total tonnage of plant nutrients were used in the Corn Belt and Lake States. By 1947, these regions were using nearly 25%, and by 1954 they accounted for almost 35% of total U. S. fertilier consumption.

Nearly all farmers, it is pointed out, have some limit to the amount of money they can invest in fertilizer. Elements of risk and uncertainty, such as weather and pest infestations, as well as anticipated market price for the output, often preclude application of quantities of fertilizer which would produce the maximum per acre yield.

Based on fertilizer usage at 1954 rates, it is apparent that most farmers are still using fertilizer, when they use it at all, at rates well below the rates of application that would be most profitable, if their capital resources permitted. According to the studies conducted by the Agricultural Research Service, the last dollar spent per acre for fertilizer at the 1954 average rates of application on all crops and pasture returned an average of $2.93 in increased yield. The rate of increased yield varies with the crop, with the return estimated at $3.40 for intertilled crops, and $1.96 for close growing crops and hay and pasture. At the '54 application rates it was estimated that to achieve the increased yield which resulted from the application of one ton of fertilizer the farmer not employing fertilizer would have had to put into production an additional 10.7 acres of land. The average cost of one ton of nutrients used in the U. S. in 1954 was about $230. The value of the increased output resulting from application of a marginal ton of nutrients was calculated at $681.

The ARS estimates that "from 35 to 40% of the increase in yield of all crops and pasture over the yield when no fertilizer is applied may be attributed to fertilizer . . . about one-fifth of the average of all crops and pasture at 1954 rates of application would be attributed to fertilizer." This would leave three-fifths of the *increase* in yield and four-fifths of the *actual* yield on the average fertilizer acre as attributable to other factors, including fertility of soil.

The ARS study offers a series of suggestions on combinations of fertilizer and acreage to produce needed national crop production goals on the most efficient basis. "In planning for highest return per acre through use of fertilizer," it is suggested, "the rate of application should be that at which marginal return exceeds marginal cost, by whatever amount is considered adequate to allow for the risks and uncertainties involved." It is recognized that if all farmers used fertilizer at optimum rates, burden-

some surpluses of some crops could readily occur, at least on a short term basis, lowering market prices and necessitating a readjustment of cost vs. yield relationships.

When a farmer is limited, through shortage of capital or other factors, to use of a limited quantity of fertilizer, he must make his decision as to how best to use the fertilizer available to him. It is suggested that when the expenditure for fertilizer must necessarily be limited "(1) optimum use among specific crops occurs when the rate of application on each crop is such that the return from the final unit applied (marginal return) is the same for all crops; and (2) optimum use of a fixed quantity of fertilizer occurs when it is applied on the crop and at the rate per acre on that crop that will permit the maximum average return on the total investment in fertilizer."

It is further suggested that, "if the fertilizer budget is limited for a crop, the expenditure per acre needed for highest average return on the investment should be regarded as the minimum, even though some acres may be left unfertilized. It is also the maximum expenditure per acre, and if in order to absorb the fertilizer budget, use of additional acres is necessary, their use would be more profitable than a higher rate of application of fertilizer, provided additional land is available on which other variable costs are the same. Thus, the total budget available for fertilizing the crop divided by the expenditure needed for highest average return on the fixed investment in fertilizer results in the acreage that would maximize total profit on the crop within the limit imposed by the restricted fertilizer budget."

The booklet is the work of D. B. Ibach and R. C. Lindberg, agricultural economist in the Farm Economic Research Division, ARS, USDA. It is recommended as required reading for all connected with the manufacture, sale and application of fertilizer. (For sale by

(*Continued on Page* 83)

Hooker Dedicates Research Center

THE Hooker Chemical Corp., last month, held formal dedication ceremonies for its new research center at Grand Island, N.Y. Governor Nelson A. Rockefeller was the key speaker at the ceremonies which were attended by many top executives in the chemical and related industries as well as Hooker personnel.

"I take particular pleasure in participating in the dedication of this important addition to New York's research facilities," Governor Rockefeller said, "it is an important step forward in our state."

Twenty-two laboratories are contained in the approximately 70,000 square feet of floor space of the center. With the opening of the new facility, Hooker has centralized all of its research activities.

The Hooker Research Center is dedicated to R. Lindley Murray, Hooker's board chairman and former president, who, during 1941-1949, was vice president — development and research.

The Hooker Research Center faces the West Branch of the Niagara River and the West River Parkway (left) on Grand Island. The North Grand Island Bridge and the East Branch of the Niagara River are at top with the N.Y. State Thruway at upper right. Top photo shows front entrance of the research center. Executive offices are downstairs and laboratories are upstairs.

Are the Insecticides Required for Pest Control Hazardous to Aquatic Life?

Second installment of a three-part report, which was presented at the 2nd seminar on biological problems in water pollution, April, 1959, Cincinnati.

By C. H. Hoffman
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IN 1955, 0.24 lb. of gamma BHC per acre in a wettable-powder suspension was applied from an airplane on a fresh-water lake in Florida to control immature stages of May flies. The obnoxious swarms of the adults caused local residents to declare they would give serious consideration to selling their homes and moving away unless relief could be obtained. The insecticide treatment was completely effective in killing the May fly nymphs and apparently had no effect on fish or other aquatic life (Lieux and Mulrenna 1955).

A detailed field study was made in 1955 in Delaware to determine the effect on wildlife of Strobane and other insecticides used for mosquito control on tideland areas (George, Darsie, and Springer 1957). Gamma BHC, DDT, and Strobane in oil solution were applied simultaneously by airplanes to similar habitats at the rates of 0.1, 0.2, and 0.3 pound per acre. There was no significant difference between deaths of estuarine fish and blue crabs occurring in treated and control plots, or among the three treatments. Both field observations and crab-pot counts showed that the fish and blue crabs avoided areas of high insecticide concentration. However, the marsh fiddler crab was reduced greatly in numbers by all three toxicants.

A hazardous food chain relationship has shown up in connection with a treatment of Clear Lake in California with TDE to control the Clear Lake gnat, a serious nuisance to residents and to tourists, who enjoy vacationing and the excellent fishing on that lake. Our Division had an important part in developing the use of TDE for almost complete control of this pest, with no apparent damage to fish, which was considered an outstanding accomplishment. Now, according to Rudd (1958), repeated treatments of the lake may be the indirect cause of the death of hundreds of grebes. A fat sample from one bird showed a high concentration of TDE. Samples of visceral fat from several species of fishes taken six to eight months after the last spraying showed from 40 to over 2,000 ppm of TDE. The herbivorous species of fish had the lowest concentration and the predaceous species the highest. Studies are under way to determine whether diatoms and algae and their planktonic animal feeders also contain the chemical. Further investigation may reveal the full story of this apparent long food-chain reaction, which seems almost fantastic in view of the small amount of insecticide required to control the gnat.

In August 1958, the Entomology Research Division and the Plant Pest Control Division of the U. S. Department of Agriculture and the Bureau of Sport Fisheries and Wildlife of the U. S. Fish and Wildlife Service cooperated in field studies to determine the effects of Aldrin, Toxaphene, and Heptachlor sprays used for control of grasshoppers on aquatic life in streams within the treated areas. Results will likely be published by the Fish and Wildlife Service.

Some limited field observations on the effect of Heptachlor on aquatic life have been made in connection with the imported fire ant eradication program. In Hardin County, Texas, 1,400 acres were treated with granular Heptachlor at the rate of two pounds per acre. Canal banks were hand-treated to protect fish, but some of the insecticide blew into the canals. As recorded by Lay (1958), fish and other aquatic forms were still dying

14 days after treatment. Though some live fish and crayfish were present in cages, seining indicated smaller populations than in pre-treatment samples.

In 1958, in cooperation with the Plant Pest Control Division, R. A. Hoffman of this Division, made some incidental observations on fish in a 900-acre area in Montgomery, Ala., treated for imported fire ant eradication in which the pasture portion contained a shallow 1/6-acre pond and a deep (maximum 6 feet) 2½-acre farm pond, both with warm-water game fish (unpublished). The pilot endeavored to avoid direct treatment (heptachlor granules at 2 pounds of heptachlor per acre) of the large pond, but not the smaller one. Much of the land area drained into the large pond. Dead fish, mostly stunted bluegill sunfish, were found on the surface of the shallow pond, but none in the deep pond.

Early in April 1959, representatives of the Entomology Research Division and the Plant Pest Control Division, Fish and Wildlife Service, Public Health Service, Alabama Department of Conservation and Agriculture, and the Alabama Agricultural Experiment Station, met to consider plans for cooperative studies to determine the effect of insecticides used to eliminate the imported fire ant on a large area basis, on fish and wildlife, their food-chain organisms, water contamination, and beneficial insects.

Harrington and Bidlingmayer (1958) made a detailed study of the effects of Dieldrin on fish and invertebrates in shallow ditches within a 2,000-acre salt marsh in St. Lucie County, Florida. The county government had resorted to the use of an airplane application of Dieldrin granules at the rate of a pound of toxicant per acre to eliminate sand fly larvae, the adults of which cause almost unbearable annoyance to people living near marshes. The fish kill was very heavy, and by extrapolating data from the two ditches, the authors estimated that 20-30 tons of about 30 species were killed. However, by the fourth week after spraying there was an increase in killifishes and by the eighth week some species were abundant. Mollusks appeared unharmed by the spray, but crustaceans and crabs were virtually eliminated.

In 1954, a cooperative study was undertaken by the Department of Agriculture and the Public Health Service to determine the toxicity of run-off waters from hospital grounds treated with Dieldrin at the rate of 4-⅔ pounds per acre to control white-fringed beetles. Bioassays of run-off water following the first rain after treatment, which drained from the grassy slope into a storm sewer, showed it to be toxic to fathead minnows at a dilution of 1 to 3 (Tarzwell and Henderson 1957). The run-off was estimated to contain 0.128 p.p.m. of Dieldrin. Apparently there was no opportunity for the insecticide diluted by rain to pass over untreated soil before reaching the storm sewer.

A recent laboratory study (Tarzwell 1958), provides information on the comparative toxicity of several chlorinated hydrocarbon insecticides to fathead minnows, bluegills, goldfish, and guppies. Under standardized conditions, including hard water and a temperature of 25° C., the 96-hour median tolerance limits (concentrations in water that kill 50 percent of test fish) for fathead minnows were as follows (p.p.m.): Endrin 0.0013, Toxaphene 0.0051, Dieldrin 0.016, Aldrin 0.028, DDT 0.034, Methoxychlor 0.035, Heptachlor 0.056, Lindane 0.056, Chlordane 0.069, and BHC 2.0. Endrin, Toxaphene, and Dieldrin were the most toxic.

Except for DDT, little is known about the effects on fish and fish-food organisms of chlorinated hydrocarbon insecticides that have been used for a number of years. There seems to be a lack of information on this subject for the chlorinated miticides including Aramite, Kelthane, Dimite, Neotran, Ovex, and Sulphenone. No information is available on new chlorinated hydrocarbon insecticides such as Shell SD-4402.

Effects of Organic-Phosphorus Insecticides

PRIOR to the first aerial spray application in 1956 of 2 pounds of 25% malathion wettable powder plus either 1 pound of yeast hydrolysate, or 1 quart of sauce base No. 2 in 1 gallon of water per acre, the formulations used to eradicate the Mediterranean fruit fly from 800,000 acres in Florida, L. F. Steiner of this Division conducted some toxicity tests with fish in concrete ponds (unpublished). He found no mortality of tropical fish, including black mollies, yellow wags, rosy barbs, blue moons, flag fish, helleries, and red moons, at 0.15 to 0.80 ppm per acre-foot of water, or of marble mollies and black moons at 1.60 ppm. There was some mortality of liberty mollies at 1.20 and 2.0 ppm. Rosy barbs and yellow cresents survived 1.20 ppm and dwarf gouramios and helleries 2.0 ppm. Field observations showed that in certain areas, especially in shallow water, considerable numbers of killifishes and certain other species were killed by these sprays (Cope and Springer 1958). There was also some loss of tropical fish, but the fish losses were considered minor in relation to the large spray area and the need for repeated spraying until the Medfly was eradicated. It was regretted that fish and wildlife specialists were not available to make studies in connection with this large action program.

Henderson and Pickering (1958) made bioassays on ten organic-phophorus compounds to determine their comparative toxicity to fathead minnows and bluegill sunfish. In general, the pH and hardness were found to have little effect on toxicity. The 96-hour median tolerance limits for fathead minnows (2 to 2.5 inches) were as follows (ppm): EPN 0.20, Paraoxon 0.33, Parathion 1.4, TEPP 1.7, Chlorthion 3.2, Systox 3.6,

Methyl Parathion 8.3, Malathion 12.5, OMPA 121, and Dipterex 180. Furthermore, most of these insecticides were found to be less hazardous to aquatic life than many of the chlorinated hydrocarbons.

In Oregon the effects of three phosphorus insecticides on 8- to 10-inch rainbow or eastern brook trout were tested by introducing the solubilized or aqueous solutions by a drip method in hatchery troughs to simulate their use for control of mosquito larvae in irrigated pastures or rice fields. (Hoffman 1957). Parathion caused no mortality at 0.05 and 1.0 ppm over periods of 14 and 28 hours; mosquito larvae are killed with 0.01 ppm. Dipterex caused no mortality of fish at 1 and 10 ppm for 72 and 24 hours; it is effective as a larvicide at 0.2 ppm. Phosdrin caused complete kills of trout at 0.05 ppm and higher.

W. G. Bodenstein of this Division has made some bioassays with phosphorus materials on the Mummichog killifish (*Fundulus heteroclitus macrolepidotus*) (unpublished). He used 2-gallon aquaria and introduced five fish per test in 6 liters of brackish water, containing a salt concentration of 4-5 ppm. The temperature of the water ranged from 21° to 26° C., the average change in any test being about 2°. Acetone suspensions of the test materials were used to determine their toxicity to fish as compared with DDT at one ppm, which produced toxic symptoms in 4-6 hours and death in 6-12 hours. The preliminary results indicated that Phosdrin, Malathion, Paraoxon, Parathion, Guthion, and Chlorthion were more toxic than DDT. Materials showing slight toxicity included DDVP, Dicapthon, Dipterex, and Ronnel (Dow ET-57).

There has been a surge in the development and use of organic-phosphorus insecticides, as indicated by the materials now in commercial or semicommercial use (Metcalf 1959). Though they are highly toxic and great concern has been expressed regarding their use, experience has shown that they can be formulated and used safely in the small amounts required for control of many insects. In aquaria tests, some have proved far less toxic to fish than several of the chlorinated hydrocarbon insecticides. Little is known regarding the effects of many of these materials on fish and bottom organisms in nature. The general-purpose residual insecticides and acaricides in this group include Parathion, Methyl Parathion, Diazinon, Guthion, Trithion, Phenkaptone, EPN, Malathion, Potasan, Dicapthon, Chlorthion, Sulfotepp, Dipterex, Delnav, Phostex, and Ethion; the contact insecticides include TEPP, DDVP, and Dibrom; the plant systemic insecticides embrace Dimefox, Phosdrin, Schradan, Demethon, Meta-Systox, Di-Syston, Thimet, Dimethoate, and Phosphamidon; and the animal systemics include Co-Ral and Trolene (Dow ET-57) (Metcalf 1959). In addition, many new organic- phosphorus compounds – including Bayer 22408, Bayer 25141, Bayer 29493, Monsanto 7769, and American Cyanamid 12009—are potentially good insect control materials that should be evaluated as to effects on aquatic life.

Effects of Carbamate Insecticides

IN other laboratory tests by Bodenstein (unpublished), Isolan appeared to be moderately toxic to Mummichog killifish, causing loss of equilibrium within 1-2 hours at one ppm and death within 15 minutes at five ppm; no deaths occurred at the lower concentration. Sevin at five ppm caused loss of equilibrium within five hours, but the fish recovered within 10 hours. Dimetan and Pyrolan at 5 ppm did not kill any fish over a 24-hour period. It appears from these data that the carbamates are moderate to low in toxicity to fish.

Sevin is a new material, which in preliminary studies appeared to be effective against grasshoppers, mosquitoes, and certain insects affecting cotton, fruit, vegetables, and forests. High levels of Sevin fed to cattle for sustained periods did not result in secretion in the milk. This insecticide is effective against the gypsy moth, and may fill an important place in control programs where DDT cannot be applied without the hazard of contaminating adjacent pastures because of drift. The apparent low toxicity of Sevin to fish suggest its possible use in areas that include important fishing streams. However, research should be undertaken in the field to evaluate its effects on fish-food organisms and fish. In April 1959, a preliminary study was started near Raleigh, N. C., by workers of Cornell University in cooperation with the Plant Pest Control Division to obtain information on its effects on aquatic life, fish, and honey bees. Another field study involving the spraying of about 75,000 acres of woodland infested with the gypsy moth is being planned for May 1959 by the U. S. Department of Agriculture and the New York Department of Agriculture and Markets, assisted by the New York State Conservation Department and College of Agriculture.

Effects of Other Insecticides on Aquatic Life

OTHER types of insecticides coming into use and about which little is known regarding their effects on fish and fish-food organisms include Barthrin, Tedion, and Thiodan.

Overall Effects of Insecticides

SINCE insecticides are poisonous and therefore potentially hazardous to aquatic life, every effort should be made to avoid the contamination of ponds, lakes, and streams. These harmful effects, as indicated by observations recorded in the literature, are minor in view of the vast quantities used annually. Most of the large-scale control operations are under the direct supervision of competent Federal and State authorities, who have

(*Continued on Page* 89)

THESE MEN HAVE LEARNED FROM EXPERIENCE THAT TOXAPHENE MAKES DOLLARS...AND SENSE

Hartford Jackson, Columbia, La. *"I set about the best cotton crop I have ever seen, following the toxaphene, toxaphene-DDT control program . . ."*

D. L. Hall, Eudora, Ark. *"The toxaphene and toxaphene-DDT control program certainly worked for me, and made me money . . ."*

W. E. Moore, Sherrill, Ark. *"We were able to pick cotton two weeks earlier on the acreage where we followed this program. It really paid off for us . . ."*

H. C. Bradney, Montrose, Ark. *"This program saves me expensive late-season applications and does an excellent job. Last year I cut my insect control costs in half . . ."*

O. L. Cox, Ruleville, Miss. *"I got on the toxaphene program early in the season and continued on a regular schedule. I believe those six early applications paid more dividends than anything we did with our cotton crop all year long . . ."*

P. E. Cloutier, Bermuda, La. *"We set one of our best crops last year, and we think the toxaphene, toxaphene-DDT insect control program was a big factor. We're basing our 1959 program on the same plan . . ."*

Morris A. Roberson, Gilliam, La. *"I like the early production and early harvest that comes with the toxaphene insect control program. We had good control all season, and I plan to use the same program this year . . ."*

Clarence R. Smith, Cleveland, Miss. *"We believe in this program. It gave us excellent insect control, saved us money, and helped us make a cotton crop under adverse conditions . . ."*

O. L. Garmon, Jr., Marks, Miss. *"I used the toxaphene program on more than 700 acres of cotton. I know you need to get the overwintered boll weevil, and this program does that. I had good insect control all year . . ."*

Insecticide salesmen have to do more than just take orders for dusts and sprays. In the Mid-South, for example, progressive formulators and dealers are showing cotton farmers how a planned, season-long insect control program based on toxaphene can be the most satisfactory—and profitable—practice. These statements from farmers already following such a program reflect the growing interest in more effective use of insecticides.

NA59-6

TOXAPHENE

A product of the Agricultural Chemicals Division
HERCULES POWDER COMPANY
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900 Market Street, Wilmington 99, Delaware

Basic Principles in Selecting A New Granulation Plant

by J. C. Sharp

This discussion by J. C. Sharp of Spencer Chemical Co., Kansas City, Mo., was presented at the Fertilizer Industry Round Table held in Washington, D. C., November, 1958.

FOR this discussion, it is assumed that principles of granulation are understood. That, for example, some grades require auxiliary heat and liquid phase other than that supplied from the reaction of the ingredients which go to make up the most economical formula. That other grades require heat and liquid phase generated from the reaction of the ingredients in the formula to be diluted or removed in order to control granulation. In still other grades, the temperature and liquid phase are in about the correct balance for optimum granulation.

Generally, grades in all three of the above categories have to be produced to meet the demand in most locations. The relative tonnage of grades that fall in each category will determine the optimum method of bringing about the proper heat and liquid phase balance.

For grades that require auxiliary heat and liquid phase, there are two ways that are used extensively. One is the use of steam. The other is the use of heat generated when sulfuric acid is reacted with ammonia even though the ammonia in the most economical formula does not exceed the amount that can be absorbed by the superphosphates.

When the demand for grades that require auxiliary heat is great enough, steam generally costs about one-tenth as much as sulfuric acid per ton of finished product. When the demand for such grades is small, the payout on the steam plant may never be realized.

For grades where the lowest cost formula produces too much heat and liquid phase, provision must be made to recycle fines in order to reduce the temperature and to lower the liquid phase. On the other hand, temperature and liquid phase may be reduced by replacing liquids in the formula with solids.

On some grades, 5 to 10 per cent of the formula cost may be saved by controlling temperature and liquid phase by recycle. This method of controlling temperature and liquid phase increases the screening and drying capacity required and, in addition, extra equipment must be employed to handle the recycle for such control. If only a small tonnage of such grades is required, the equipment payoff may never be realized.

To make another generalization, the trend has been steadily toward higher concentration because of several factors. One, it costs just as much freight on a ton of fertilizer that contains 20 units of plant food as it does for a ton of fertilizer that contains 40 or more units of plant food and freight rates continue to increase regularly. Two, other fixed costs such as bags and handling, tend to increase the unit cost on low analysis fertilizer faster than it does on high analysis fertilizers.

Greater concentration calls for more liquid materials, like phosphoric acid and nitrogen solutions, consequently equipment that is not designed to cope with high liquid phase will likely become obsolete before it can be amortized.

Metering and weighing equipment should be accurate. Corner-cutting causes consternation in this category. Inferior equipment causes off-grade product which is costly because of penalties on deficiencies, overages on material or plant food being given away. In addition to direct money loss, the company's reputation is jeopardized.

On the other hand, the best equipment available does not insure efficient operation. The human element must be reckoned with. Inefficient personnel will, however, be able to get good results out of accurate equipment, whereas not even efficient personnel will be able to get good results with poor equipment.

The plant should be designed to meet present needs with ample space to install additional equipment as needed.

To follow the process flow from raw materials to finished product, dry raw materials should be ground to pass a 10 mesh screen and mixed thoroughly. Anhydrous ammonia and solution, when used in combination as a source of nitrogen, should enter the ammoniator or pug mill through a common sparger. To insure even flow through the flow meters, each liquid should have a minimum pressure of 60 p.s.i.g. at the respective flow meters. Water should also have at least 60 pounds pressure if it is to be mixed with anhydrous ammonia. Downstream from the flow meters, the free liquids flow into a specially designed mixing pipe and then through the sparger into the ammoniator or pug mill.

Acids that are used for the purpose of increasing temperature and liquid phase should be added to the ammoniator, or pug mill, through an acid sparger. Never attempt to bring ammonia or nitrogen solutions and acid together inside the pipe or sparger. If both sulfuric acid and phosphoric acid are used, they may be mixed downstream from the flow meters ahead of a common sparger.

When sulfuric acid is used solely for the purpose of neutraliz-

(*Continued on Page* 87)

Dry dust insecticides cost less to produce– cover more uniformly

when formulated with

CELITE

diatomite fillers

When applying dry dust insecticides, it's the volume that counts. Yet when you buy inerts, you pay by the pound. That's why Celite saves you money because it gives you as much as 10 times more volume than equal weights of other mineral fillers.

Another important Celite benefit is the neutralizing of dense let-down agents. These usually pack down and form pockets of inactive ingredients. But when a small percentage of Celite is present its high bulking action keeps the final dust fluffed up, assuring uniform poison dispersion on any foliage.

Ask your Celite engineer to demonstrate these advantages in your plant. Call him at your nearest J-M sales office or write Johns-Manville, Box 14, N.Y. 16, N.Y. In Canada, Port Credit, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products

Johns-Manville CELITE

INDUSTRY'S MOST VERSATILE MINERAL FILLER

WASHINGTON REPORT

By Donald Lerch

THE imported fire ant controversy is becoming a real hassle inside the state of Alabama. Both sides are hurling charges that the other is deliberately misinforming the public—a serious matter since national wildlife conservation groups—located far from the scene of the eradication program—are basing their charges upon so-called facts issued by the Alabama conservationists.

The political fire has gotten so hot that Julian Elgin, Chairman of the Alabama Fire Ant Committee, recently called for the complete abolition of Alabama's Department of Conservation. Elgin declared, "Trapped by their own admission that the primary aim of the conservationists was to expand bureaucracy, these dapper dans of the doodler set have hurled iniquitious invective at the fire ant program."

Elgin further charged that Alabama conservationists "have obliterated their professional obligations by obsequious observations slanted to misinform and misguide the public." Indeed, Elgin concludes, "citizens of all classifications should bestir themselves to ascertain whether the conservation department is worthy of consideration."

Meanwhile, a national wildlife conservation organization has renewed its attack against the USDA's imported fire ant eradication program. In a recent statement, this group claimed that the primary food source for fire ants is other insects. Consequently, this group holds that the fire ants do not pose much of a problem to agricultural crops, livestock or humans, while control measures do pose a hazard to wildlife.

At issue are a set of facts which have been gnarled and twisted out of shape in the hot political battle raging in Alabama. In one attempt to weed out fact from fiction, the Alabama Farm Bureau Federation surveyed farmers. In the survey 78 per cent of the 1080 farmers in the fire ant program replied. These who replied own 318,093 acres, or 93% of the acreage treated in the program. Of those replying, 98% said that the chemical control measures cleaned up the fire ant infestation; nearly 98% said they had neither observed nor heard of any appreciable damage to wildlife from the program; and 802 of the 805—virtually 100%—affirmed that the control program is of sufficient value to be continued until the fire ant is eradicated.

Private checking here in Washington and elsewhere convinces us that the real fate of the fire ant control program will be spelled out in the legislatures of the states involved in the program. Indications now are that all states will go on record favoring the program, and many will seek larger appropriations to rid their states of the fire ant pest.

* * * * *

Fertilizer manufacturers will be debating for some time to come about a new formula for predicting the next year's sales of fertilizers. Dr. R. A. King, Professor of Agricultural Economics at North Carolina State College, unveiled the formula at the National Plant Food Institute meeting at the Greenbrier.

While not yet completely checked out, the formula has proved its value in 42 out of 46 years when tested against past sales records for fertilizers. The big question is how well it will prove itself in the future.

A weak factor in any formula is that some important elements cannot be figured in. Before World War II, for example, the simple projection of farm income was a good indicator as to how much fertilizer would be sold in the coming year.

The rising tide of education on values of using fertilizers plus the falling prices of fertilizers in comparison to farm prices, has made this simple approach too inaccurate for use. Dr. King is figuring such elements as fertilizer price versus farm prices into his formula.

The effects of fertilizer education, promotion by fertilizer companies, trends in technology, such as the development of improved sprinkler irrigation or the new dwarf wheat which can use more nitrogen without lodging, cannot be figured into the formula as yet.

Only the test of time will tell how good the new formula really is for predicting the next year's fertilizer sales. Without doubt, the new formula does give everyone in the fertilizer industry an added tool to assist in making the marketing of fertilizers more effective.

If the new formula works for fertilizers, other groups may be motivated to develop a formula to

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If the new formula works for fertilizers, other groups may be motivated to develop a formula to

predict the sales of other agricultural chemicals.

* * * * *

Those companies planning expansions during the "booming 1960's" might do well to take a hard look at figures on the available manpower situation.

Sen. Kenneth B. Keating of New York has looked into these figures and has come up with some startling conclusions. We will have 2,000,000 fewer men in the productive 20-to-30 age bracket during most of the 1960's than we have right now. By 1970, he adds, we will have 20,000,000 in the less productive over-65 bracket.

Though this alone is bad enough, Sen. Keating points out that the 1960's will place the heaviest drain in our history on professional and technically trained men and women. These are the kind pesticide and fertilizer manufacturers will need to man any expansion program.

Over-all, Sen. Keating figures, our economy will need 50% more professional and technical workers, 30% more craftsmen, and 30% more semi-skilled workers in the 1960's than we have today in the nation's work-force.

This means much tougher competition for qualified manpower in the future. Chances are that companies with expansion in mind would benefit by including a manpower recruitment program in their plans. Companies which are beginning with high school students now are likely to get the pick of technically-trained college graduates in the 1960's, when they need them the most.

* * * * *

Many chemical manufacturers throughout the nation are taking a hard look at provisions of the recently-passed food additives amendment to the Food, Drug and Cosmetic Act.

Firms which make antibiotics, feed additives, and veterinary products, as well as agricultural chemicals, see the provisions as slowing down the introduction of new products by many years, and greatly raising the costs of research.

These companies report that the Food and Drug Administration crack-downs under the new law already are throwing the marketing of some fairly widely used products into chaos. Questions are being raised on how far FDA will go in this direction.

A particularly stiff definition is that a veterinary drug may become a food additive, through addition to the animal's feed or drinking water, whether or not residues of the drug become a component of human food derived from the animal. The same drug may become a food additive regardless of its route of administration, if its residues or conversion products become part of human food derived from the animal.

Pesticides regulated under the Miller Amendment and the Federal Insecticide, Fungicide, and Rotidenticide Act, of course, are excluded from the food additives amendment.

Nonetheless, similarity in the objectives of the food additives amendment suggests the value of watching trends of administration of both laws.

* * * * *

A little noted report of the Memphis (Tennessee) Rose Society is stirring up interest here in the importance of garden clubs to the general public approval of pest control programs.

When the USDA's spray program to control the white fringe beetle recently came under attack, an investigating committee of the Memphis Rose Society came to USDA's defense.

In effect, the Rose Society stated that its members use chemicals effectively and without harm to birds or wildlife; that crops and pasture land would become worthless without chemical control programs; and that if Memphis were sprayed a section at a time "no great harm can come to anyone."

This report confirms a private survey made on Long Island at the height of the controversy over the Gypsy Moth eradication program in New York. Citizens who regularly sprayed or dusted trees and flowers in their own gardens openly laughed at the adverse stories in some newspapers.

What these experiences appear to point up is that personal experience with spraying is the surest way to convince people of the values of pest control and pest eradication. Home gardeners are natural allies of the farmers in convincing doubters as to the great benefits proper use of pesticides bring to mankind.

* * * * *

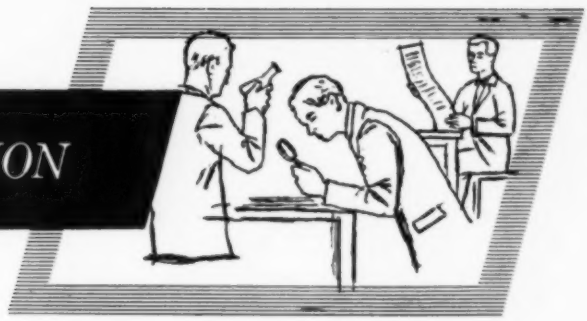
A world Agriculture Fair, which could be an excellent showcase for the benefits agricultural chemicals are bringing to farmers everywhere, will be held in New Delhi, India, December 11, 1959, to February 14, 1960.

Heralded as one of the largest fairs of its kind, it is expected to attract exhibits from all over the Free World and from the Soviet Bloc. Most important, it will be held in an area of the world where governments and people now are vitally concerned with increasing food supplies to meet the challenge of an exploding population.

The U. S. Exhibit at the Fair will cover more than 100,000 square feet. According to USDA, it will demonstrate how the American farmer uses the results of basic research to boost productivity and living standards. The Exhibit gives U.S. agricultural chemicals firms a rare opportunity to further develop the Southeast Asian market for the sale of more agricultural chemicals.

The U. S. Exhibit at the New Delhi World Agriculture Fair will be under the overall direction of Henry Kearns, Assistant Secretary of Commerce for International Affairs, and Clarence Miller, Assistant Secretary of Agriculture, for Marketing and Foreign Agriculture.★★

TECHNICAL SECTION



Controlling Recycle to the Ammoniator-Granulator

THIS discussion on control of recycle refers to that material passing the lower deck of the classification screen. The coarse fraction remaining on the upper screen normally passes without adjustment of flow to mill for reduction of granule size and return to the flow of material ahead of the classification screen.

The equipment required is very nominal and virtually no labor is required other than normal supervision. Essentially what is required is a hopper having capacity of about 25% the hourly production rate, and a method of at least rough control of flow rate from the hopper. The hopper can be located immediately beneath the classifiction screen or otherwise intermediate between the screen and the flow of material to the ammoniator-granulator. With batch mixing, a satisfactory arrangement is to use a bin above the weight hopper into which a uniform amount of the fine recycle can be weighed in addition to the dry ingredients. Some means of rough control of the rate of flow from the hopper in a continuous system is necessary, say within 5% accuracy, and also provision should be made for easy adjustment of flow rate. A recycle of 30% is 600 pounds per ton of production. Control of the fines flow rate within 5% is within 30 pounds per ton of production. Vibrating feeders or a gate device are satisfactory.

This simple addition to a granulation unit can aid operating personnel, reduce costs and improve product far beyond the added cost of installation, particularly during the early stages of operating the unit or when making major adjustments in formulation. Once the formulation and equipment operation is well stabilized, there is much less variation in rate of producing the fine fraction.

The problem is that some circumstance causes an excess accumulation of fines, such as a new formula, a different lot of superphosphate or other material having different moisture content or particle size, thus changing the degree of wetness, or a holdup in the flow of ingredients to the process temporarily increases the proportion of recycle to dry and liquid ingredients. The immediate result is that the fertilizer mass becomes dryer, the range of granule size becomes smaller and the proportion of fines produced increases. Unless checked, the cumulative fines and overload on the whole system can cause a shutdown. The purpose of the hopper and method of controlled return rate gives the necessary time to adjust the formula, to add water or make other change necessary without an excess accumulation.

The condition causing fines also has to be adjusted, but time is provided and frantic moments avoided. A temporary condition causing the mass to dry can cause a surging effect, wherein a dry condition at one time, though adjusted to, will cause a dry condition in the mixer several minutes later when the effect of fines produced returns again to the mixer. Without a means of leveling off the rate of fines return, a difficult situation exists for the operators.

It is not suggested that fines be removed from the system, only that the rate of return be controlled. The improved product and operation far outweigh the nominal investment required.

Participating in the discussion on control of recycle at the Fertilizer Industry Round Table meeting, November, 1958, in Washington D. C., was Roger C. Smith of the Eastern States Farmers Exchange. His comments are reproduced here.

•

Control of Alfalfa Weevil

The alfalfa weevil (*Hypera postica* Gyll.) appears to be well established in Connecticut. Both adults and larvae feed upon alfalfa, with the larvae causing principal injury to the first crop. Several other weevils, which also feed upon alfalfa, have long been present in Connecticut fields. Among these are several which are sometimes mistaken for the alfalfa weevil. The insects which cause the most confusion are the lesser clover leaf weevil, *Hypera meles* (F.); the clover leaf weevil, *Hypera punctata* (F.); *Hypera meles* (F.); *Sitona flavescens* (Marsh.); and the clover root curculio, *Sitona hispidula* (F.) Between these insects, and the alfalfa weevil, differences in size, color and habit are sufficient to be useful in field identification.

Control of the alfalfa weevil can be obtained by the proper application of insecticides. Granular materials applied prior to new growth in the spring have given good results. In 1958 tests, granular insecticides were mixed with fine sand as an extender, and these applied with a hand-operated rotary type duster. A 2½% granular heptachlor treatment (1.0 lbs. active per acre) showed an 18.5% increase in yield over the check, on first cutting of alfalfa.

The same treatment also protected the second crop—with benefits from a residual effect.

Summarized from a report by R. A. Quinton, and published in Bulletin 621, April, 1959, by the Connecticut Agricultural Experiment Station, New Haven, Conn.

NEW BOOKS

Diseases of Field Crops, by James G. Dickson. Published by the McGraw-Hill Book Co., New York. 517 pages, price $8.50.

This book brings together on a world-wide basis the current knowledge and references on the diseases of the field crops which comprise the cereals, grasses, legumes, and fiber plants. It is a revised edition which has been enlarged to include several new diseases, new illustrations, and much recent research in the field.

Diseases are arranged under each crop plant on the basis of primary causal factor. The role of nematodes in inciting disease and in aiding in the development of fungal diseases is also discussed. More than 60 diseases incited by viruses, 40 by bacteria, and 300 by fungi are listed and discussed in relation to the field crop plants.

The discussion of each disease emphasizes the characteristics useful in identifying the disease, and information basic to its control, with emphasis on the practical problems of crop rotation, adaptation, and the use of disease-resistant varieties.

Dr. Dickson is a professor of plant pathology at the University of Wisconsin.

The Agricultural Value of Phosphate Fertilizers Which Economise in the Use of Sulfuric Acid, a report on a study by Dr. George W. Cooke, Rothamsted Experimental Station (United Kingdom). Published by the European Productivity Agency of the Organization for European Economic Co-operation, Paris. 90 pages.

The Organization for European Economic Co-operation was founded in April, 1948. The European Productivity Agency, which is responsible for the publication of this report, was set up as a branch of the OEEC in 1953. Its task is to stimulate productivity among the member nations.

The present report, compiled on the basis of information made available by the individual countries, summarizes and compares experimental results in regard to the agricultural value of each phosphate fertilizer studied. During recent years, phosphate fertilizers for which no sulfuric acid is used during manufacture have been developed. In considering the commercial possibilities of these processes for treating phosphate rock, it is necessary to take into account whether there is a difference in the agricultural value of the products when compared with that of well-known phosphate fertilizers such as superphosphates. Areas introducing new phosphate fertilizers will, no doubt, undertake agronomic tests under their own conditions, but initial guidance in the value of novel products may be obtained from this report which describes the results of pot tests and field experiments which have already been carried out in other countries.

In this report, Dr. Cooke has collected and correlated the results of all suitable experiments comparing phosphate fertilizers made by processes which economize in sulfuric acid with other well-known phosphates.

Soil Fertility and Fertilizers, by Samuel L. Tisdale and Werner L. Nelson. Published by the MacMillan Co., New York. 430 pages, price $7.75.

The fundamental concepts of soil fertility and fertilizers are presented in a manner suitable for use by agricultural students at the junior and senior levels in college.

Following a brief historical introduction, several sections are devoted to the elements required in plant nutrition, their role in plant growth and development, and the soil reactions that these plant nutrients enter into and which affect their availability to crop plants. The next several chapters are concerned with the manufacture, properties, and agronomic value of fertilizers and fertilizer material.

The final chapters cover the subject of soil fertility evaluation and the use of fertilizers in a sound management program.

Mr. Tisdale is director of the soil testing division of the North Carolina State College. His co-author, Mr. Nelson, is midwest manager of the American Potash Institute, Inc., and was formerly professor of agronomy at North Carolina State.

"*Principles of Fungicidal Action*," by James G. Horsfall. xx + 279 pages. 1956. Waltham, Mass.: The Chronica Botanica Co., New York City: Hafner Publishing Co. Price $6.50.

This book is surprisingly clear and an interesting presentation of the complex subject matter. The author is one of the foremost as well as most original students of the subject, so that his review and analysis are soundly based on his own experience. His discussion is not dogmatic, however; on controversial questions he gives all significant viewpoints.

The outstanding impression is of the continuous evolution of speculation and knowledge about what fungicidal chemicals actually do to fungi and the means by which they achieve their toxic action. It is evident that scarcely any of the problems have definitely been solved so far.

The scope of the book includes chemical protection of fabrics, timber, etc., against decay as well as of living plants against disease. The introductory chapter contains a historical summary and some definitions. Chapter II takes up fungicidal action and its measurement; Chaper III, chemotherapy and its measurement; Chapter IV, mobilization of a residual protectant; Chapter V, permeation into the fungus; Chapter VI, disruption of cellular organization; Chapter VII, effect on mitosis, morphology, and growth Chapter VIII, effects on metabolism of the fungus; Chapter IX, chelation of needed metals; Chapter X, the action of metals; Chapter XI, the action of sulfur; Chapter XII, the action of organic sulfur compounds; Chapter XIII, action of quinones and other ketones; Chapter XIV, the action of heterocyclic compounds; Chapter XV, the chemotherapy of plant diseases. The bibliography occupies 28 pages and there are both general and author indexes. —(*Paul R. Miller and Jessie I. Wood, Plant Disease Epidemics and Identification Section*)

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Farmer acceptance of high-analysis,

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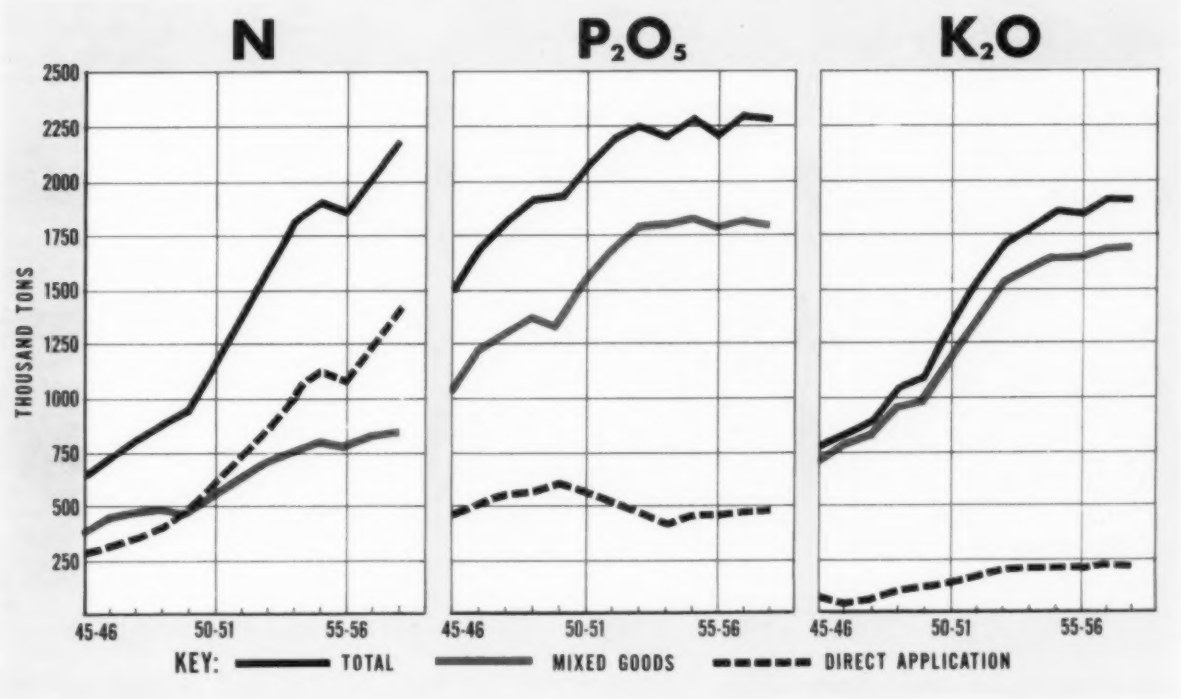

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PLANT FOOD REMOVED BY CATTLE AND HOGS PER TON OF PRODUCT SOLD

	N lbs.	P_2O_5 lbs.	K_2O lbs.
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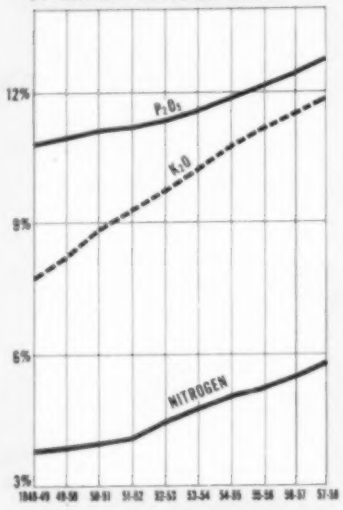
Milk	12	4	3

AVERAGE PLANT FOOD CONTENT OF MIXED FERTILIZER IN U. S.



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Crop	Yield	Part of Crop	N lbs.	P_2O_5 lbs.	K_2O lbs.	Total
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	2,000 lbs.	burrs, leaves and stalks	45	15	45	105
	Total		105	45	65	215
CORN	100 bu.	grain	90	35	25	150
	3 tons	stover	70	25	95	190
	Total		160	60	120	340
WHEAT	40 bu.	grain	50	25	15	90
	1.5 tons	straw	20	5	35	60
	Total		70	30	50	150
OATS	80 bu.	grain	50	20	15	85
	2.0 tons	straw	25	15	80	120
	Total		75	35	95	205

It will pay you to start now to get more of the nitrogen market and more of the total fertilizer market by putting more nitrogen in mixed fertilizers. You get more of the farmer's fertilizer dollar when you supply his nitrogen needs with mixed fertilizer than when you sell him low-nitrogen mixtures that must be supplemented with extra applications of nitrogen.

New Techniques

Today you are in a better position than ever before to make and sell high-nitrogen fertilizers at a profit. You have the market and the methods. The development of new ammoniation techniques enables you to greatly increase the nitrogen content of mixed fertilizers, with all the nitrogen derived from low-cost ARCADIAN® Nitrogen Solutions.

When you balance your fertilizer with adequate nitrogen to meet crop requirements, you also help to insure the best possible return from the phosphorus and potash in your fertilizer. Research has proved that sufficient available nitrogen increases a plant's efficient use of phosphorus and potash.

Bigger Dollar Volume

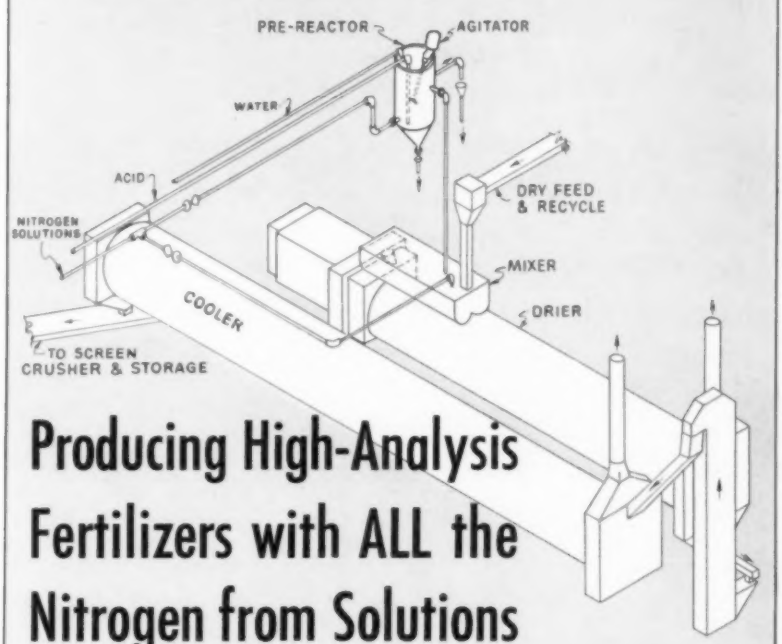
By producing high-analysis, high-nitrogen mixed fertilizers, you can put a bigger dollar volume of tonnage through your plant. You can also save money in storage and shipping costs per unit of plant food. These costs are becoming more important, with increasing freight rates and the necessity to warehouse more tonnage in late seasons.

With high-nitrogen fertilizers, you increase the farmer's profit, your profit and your dealer's profit. Your dealer can make better use of his storage and trucking facilities. He has less storage cost per dollar of inventory and he hauls a higher value pay load. Most important of all, he can supply his farmer customer with his complete plant food requirements in a one-sale, one-package deal. This builds exclusive customers and minimizes the danger of losing business to a competitor.

Call Nitrogen Division

It will pay you to start now to make and sell more high-nitrogen mixed fertilizers. Get all the facts on the new and different production techniques that enable you to produce high-nitrogen mixed fertilizers with all the nitrogen derived from low-cost ARCADIAN Nitrogen Solutions. Contact: Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y.

Typical high-analysis fertilizer operation with pre-reactor.



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Keeps Acid Out of Mix

The pre-reactor method keeps all acid out of the mix and confines it to the pre-reactor along with the nitrogen solution. Here, the acid neutralizes the free ammonia in the nitrogen solution. The heat generated by this reaction is dissipated through evaporation of water by the pre-reactor. This avoids the old problem of excessive heat in the liquid phase.

In fact, the pre-reactor provides better control of the heat and water content of the mix. By adding water to the pre-reactor at an easily determined rate, a constant temperature is maintained and a slurry of uniform nitrogen and water content is fed to the mixer. It's easy to efficiently neutralize all the ammonia in excess of that needed to ammoniate superphosphate.

How the Pre-reactor Works

Specified amounts of acid and nitrogen solutions flow continuously into the pre-reactor through separate distributors. The liquid mass undergoes violent churning by agitator propellers. Water is added to cool the mass and keep it in a liquid state. It is this liquid condition that prevents much of the uncertainty, risk and loss encountered with conventional ammoniator-mixers where the mass of ingredients is relatively dry.

When the reaction is completed in the pre-reactor, the effluent flows by gravity into the mixer to combine with dry and re-cycle materials. This effluent can be delivered into the normal granulating system at a temperature, physical condition and moisture content that favors granulation and holds re-cycle to a minimum. By properly using a pre-reactor in tandem with an ammoniator-mixer equipped with a double-shafted pug mill, quality granular fertilizers are produced with a recovery of 97 to 98% of nitrogen input.

Get Full Details

If you are interested in producing high-analysis fertilizers in 2-1-1, 3-2-2, 1-1-1 and 1-0-1 ratios, with all the nitrogen from solutions, it will pay you to investigate the new pre-reactor technique. You'll find that you get big benefits in safety, precision and control. And you increase your profits by obtaining *all* your nitrogen from low-cost ARCADIAN Nitrogen Solutions.

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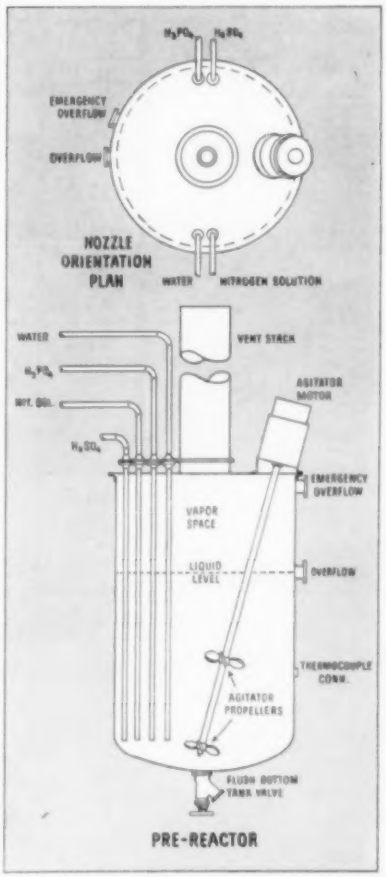

HERE'S THE BIG LINE OF Arcadian® NITROGEN SOLUTIONS

When you purchase your nitrogen requirements from Nitrogen Division, Allied Chemical, you have many different nitrogen solutions from which to select those best suited to your ammoniation methods and equipment. You are served by America's leading producer of the most complete line of nitrogen products on the market. You get formulation assistance and technical help on manufacturing problems from the Nitrogen Division technical service staff. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions.

	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	–25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	–36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	–30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	–52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	–15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	– 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	–17
15	44.0	28.0	40.0	15.0	17.0	12.7	1.052	29	1
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
Anhydrous Ammonia	82.2	99.9	—	—	—	24.3	0.618	211	–108

Other ARCADIAN® Products: URAN® and FERAN® Solutions • Ammonia Liquor • N-dure® A-N-L® • Ammonium Nitrate • UREA 45 • Nitrate of Soda • Sulphate of Ammonia

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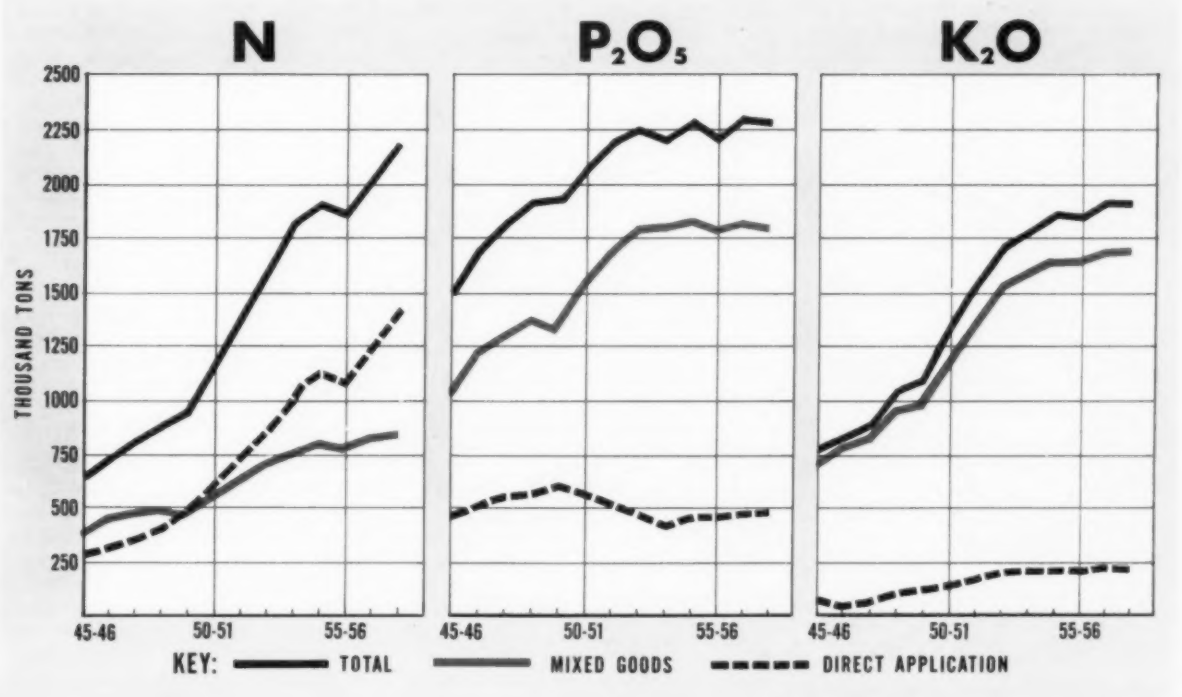

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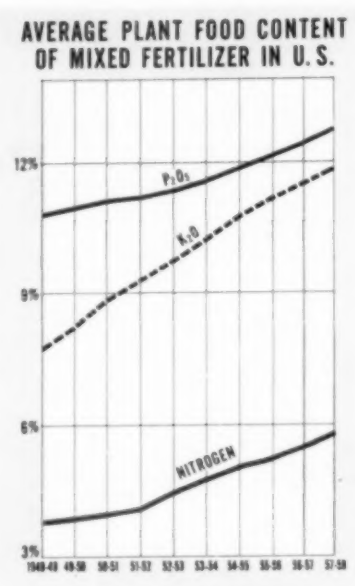

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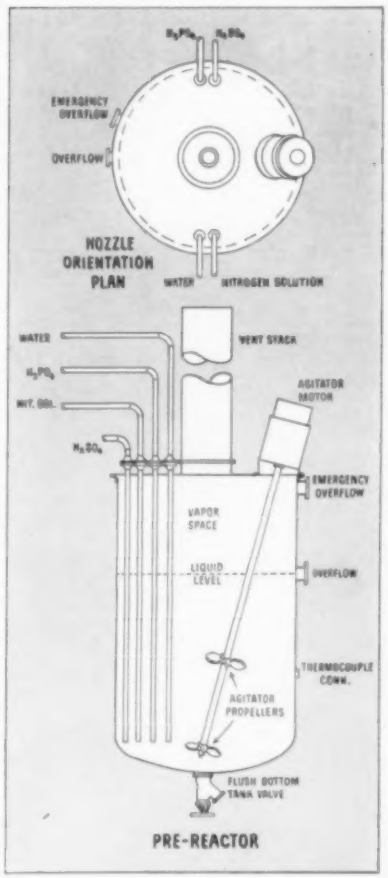
There is nothing complicated about incorporating a pre-reactor in a normal high-analysis manufacturing operation. The same standard equipment is used . . . nothing is eliminated. You'll *like* your results in volume, quality and extra profits!

For complete details on how to add a pre-reactor to your present set-up, contact: Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y. Telephone HAnover 2-7300.



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2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
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6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
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10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
15	44.0	28.0	40.0	15.0	17.0	12.7	1.052	29	1
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The AGRICULTURAL Applicator

- Applying Dope and Fabric to Airplanes
- NA-75 "Composite" Stearman
- Effects of Pesticides on Bees
- New York Gypsy Moth Program

Applying Dope & Fabric to AIRCRAFT

by Sam L. Weil
Cooper Industries Inc.
Chicago, Ill.

Photos on preceding page illustrate two things to remember when applying dope or paint to an airplane. When spraying, as in top photo, the spray gun should be from 12 to 16 inches away from the aircraft. Masking an area to be painted (bottom photo) should be done generously so that spray mist does not fall on unmasked portion of plane.

BECAUSE cloth and dope combine to give a surface of strength and flexibility which is lightweight, easily repaired, and easily replaced, they have remained a practical and desirable means of applying the skin to an airplane since the inception of heavier than air flight.

Some aircraft supply manufacturers offer a complete line of pre-sewn covers which are designed to save time, trouble, and money. The wing curves, trailing edges, and aileron spars are completely sewn to eliminate, to the greatest extent possible, work and adjustment by the installer. Most of the original tolerances on a plane, however, are not necessarily held too close, and variations can and do exist which make it impossible in some cases to furnish a perfectly fitting set of covers. In addition, if a plane has been damaged and repaired, the dimensions are liable to have been altered somewhat.

Before any type of cover is applied, however, the old covers must be removed carefully so as not to damage the structure. The methods used in originally securing the fabric to the parts should be written down and the old cover should be saved for use as a pattern and to locate openings, grommets, and inspection rings.

When the cover is off, varnish should be applied to all wooden surfaces of the frame and zinc chromate to all metal surfaces. In addition, any other necessary repairs can be made, now that the covering is off. All rough or sharp edges should be sanded down or taped over so that they will not chafe through the new cover.

A light plane, such as Piper Cub, Aeronca, and Taylorcraft, usually requires between 55 and 75 square yards of fabric. Larger airplanes, such as Waco, Stearman, and Staggerwing Beach, require from 100 to 120 square yards of fabric. Grade "A" and Irish Linen have long been the standard fabrics.

The cloth should be pulled snug, but not stretched, when it is attached to the frame because the application of dope will create the final stretching. The cloth should not be pulled tighter in one direction than another, since waviness can occur. Three methods of securing fabric to the frame are: hand stitching, metal screws, and doping to the frame.

The first two coats of dope applied to the fabric must be brushed on to obtain complete penetration. A major cause of fabric and finish failure has been the improper application of the first coat of dope. It is necessary that the fabric be thoroughly impregnated with the first coat of dope so that the two become completely interbound. Otherwise, the cloth cannot give the dope proper support and the dope will not pull the cloth up evenly. Cooper Industries is offering a first coating of dope known as "Fool Proofer" that completely penetrates both sides of the fabric and assures the best possible bond between the fabric and the coats of dope to follow. In addition, Fool Proofer is formulated with a fungicide to protect the fabric from mildew and rot. When ordinary dope is used as the first coat, it should be reduced at least 50 per cent with a thinner so that good penetration is obtained.

The number of coats necessary depends upon how the dope pulls the fabric. Four coats usually will do a suitable job. Six coats will provide a deluxe finish that, in most cases, will not show the weave of the fabric. When the finishing coats are brushed on, the dope should be used in full body, unless it is cold and will not flow properly, in which case no more than ten per cent thinner should be added. If the dope is being sprayed, a 25 per cent reduction with thinner is necessary. If a suction cup sprayer is used, one part thinner should be used for each two parts of dope. Clear dope may be sanded after the second coat is dry.

The best time for applying trim tape, patches, and drain grom-

(*Continued on Page* 84)

Metal Wings and Side Panels Features of National Stearman

A "COMPOSITE" NA-75 Stearman, reconstructed with aerial application in mind, is being offered by the National Aircraft Corp., Burbank, Calif. Among the features of NAC's Stearman are fabric covered metal wings and detachable, metal side panels for the fuselage.

One of the most popular agricultural airplanes, the Stearmans were built during World War II as primary trainers (Boeing PT-17) and were immediately available to pilots at low cost following the war as surplus. The Stearman still accounts for almost one half of the more than 4,000 planes currently certificated for aerial application under CAR Part 08, 1869.

A biplane of rugged construction, the PT-17 originally was built with wooden wings, because of the metal shortage during the war. This and a fast breaking stall—purposely designed into the wings for student instruction—were shortcomings that National Aircraft feels have been eliminated with the NA-75.

The National Aircraft NA-75 Hi-Lift wings, fabric-covered and of all-metal structure, are engineered to permit assembly or repair with a screwdriver and ordinary wrenches. Fabric clips, instead of rib stitching, secure the fabric to the three-piece bolted ribs. All ribs are blanked, pierced, and formed with punch press dies and are attached to the spar with screws instead of rivets. No drilling is necessary and field repairs can be made with a minimum of tools.

All four wings are of constant section from root to tip and use the same airfoil. The ribs, therefore, are completely interchangeable. The leading edge of the wings is not fabric covered and is assembled in small sections for ease of replacement of any damaged part without having to remove the fabric.

The fuselage of the National Stearman has been modified by the installation of ten metal side panels from firewall to tail. These panels retain the original shape of the Stearman fuselage and can be removed in about five minutes for inspection and cleaning of the fuselage.

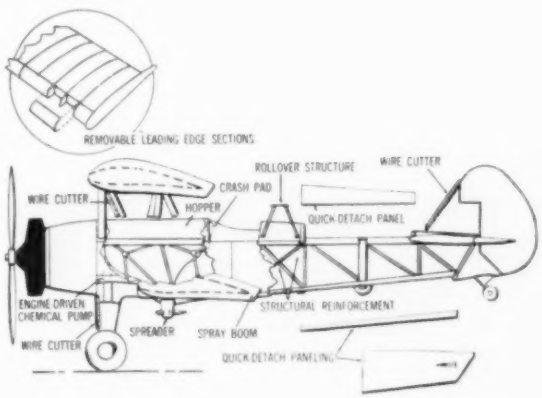
The hopper developed by National for the NA-75 is made entirely of fiber glass, and follows the original contour of the Stearman at the firewall. The hopper's capacity is 31.7 cubic feet. A quick-change, combination dust-spray unit is built into the plane and the pump, agitator drive, shut-off valve, and all plumbing to the spray boom are located inside the fuselage to eliminate drag. In addition, the spray pump and dust agitator drive are engine-driven through a variable speed power take-off which is controlled in flight.

By cutting down in the frontal area of an airfoil-type venturi spreader, NAC says that it has developed an efficient spreader with such a low drag that it is always left on the aircraft, even when spraying. To eliminate a piece of machinery, the dust gate is used for an emergency dump valve which can completely dispose of a load in five seconds. In an effort to further reduce drag, the spray boom is permanently mounted in line with the trailing edge of the wing.

For the past two years, National Aircraft has been offering its NA-75 Hi-Lift wings to Stearman operators who reportedly have experienced better lift-drag ratio and slow, stable stall characteristics.

(*Continued on Page* 82)

National Aircraft's Stearman emphasizes easy maintenance and low-drag dispersal equipment. The load is carried forward of the cockpit to give the pilot protection in the event of a crackup. Other safety features are; wire cutters on landing gear legs, wing struts, and vertical fin; and rollover structure behind cockpit.



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SPECIFICATIONS

Wing span	35 ft. 8 in.
Over-all length	24 ft. 4 in.
Maximum height	10 ft. 9 in.
Maximum gross weight	3700 lb.
Fuel	34 gal.
Oil	5 gal.
Hopper capacity	29 cu. ft. (217 gal.)
Hopper load restriction	1200 lbs.

PERFORMANCE

Normal working speed	75 mph
Take off distance @ 3700 lb	750 ft.
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Univ. of California Report

The Toxic Effects of Pesticides on Bees

STUDIES to determine the effects of pesticides on bees have been carried on by entomologists at the University of California, Riverside, since 1950. Precision laboratory test methods were devised for studying, primarily, the contact effect of pesticide dusts on honey bees, and—during the past eight years—more than 100 pesticides and nearly 100 pesticide diluents have been compared.

In addition to laboratory tests, over 25 large-scale field tests were made during the past five seasons with commercial applications of pesticides in blooming seed alfalfa fields. The results of the laboratory and field tests—showing the relative toxicity of many of the new pesticides to honey bees—are given in the accompanying table. The toxicity rating of each material was based on the normal dosage recommended for field applications.

The materials included in Groups 1, 2, and 3 are primarily contact poisons, but they may also act as stomach poisons to bees. Special care, therefore, must be taken to avoid contaminating water or food available to bees.

The materials in Group 2, although highly toxic, can be used around honey bees because of certain characteristics they have. TEPP and Phosdrin, for instance, have such short residual activity that they will kill only the bees contacted at treatment time.

Recent observations indicate that bee losses are low when highly toxic materials are used no closer than one quarter mile to colonies or blooming fields. When pesticides toxic to honey bees are used in the field, they should be applied in the early morning or late evening, when the fewest bees are present.

The results of the study indicate that, in California at least, a problem with pesticides and bees may exist in the following situations:

In alfalfa and other legume seed crops;

In cotton throughout the season because of attractiveness of blossoms and of nectaries on the leaves;

In melons, cantaloupes, cucumbers, squash, and similar crops, when in bloom;

In vegetable-seed crops when in bloom;

In blooming cut-flower and flower-seed crops;

In citrus and deciduous fruit crops during blooming;

In cover crops when in bloom under orchard trees, a condition that may be corrected by cutting or disking cover crops before treating the orchard with pesticides;

In crops—and weeds in fields, along ditches, and so forth—in bloom near non-blooming crops that are receiving pesticide treatments;

In pastures or other crops in bloom near apiaries;

At water tanks, puddles, ponds, streams, irrigation water, and other places where bees might drink; and at mixing and disposal areas where there is pesticide waste material.

The studies are being conducted by L. D. Anderson, entomologist, and E. L. Atkins Jr., associate specialist in entomology, both of the U. of California. In concluding the above progress report, Dr. Anderson said that pesticides are essential and frequently needed to produce profitable crops, as are the pollinating activities of honey bees. Therefore, he said, the cooperation of farmer, agriculturist, applicator, and the pest control industry is needed to reduce the hazard of pesticide toxicity to honey bees to the minimum.★★

Toxicity of Pesticides to Honey Bees

Group 1

Highly toxic materials that should not be used when there is a possibility of poisoning bees at treatment time or within a few days thereafter

Aldrin	DDVP	DNOSBP (DN-211)	Lindane
BHC	Diazinon	EPN*	Metacide*
Calcium Arsenate*	Dibrom	Guthion*	Methyl Parathion*
Chlordane	Dicapthon	Heptachlor	Parathion*[1]
Chlorthion	Dieldrin[1]	Lead Arsenate*	Sevin[1]

Group 2

Highly toxic materials that can be used around bees when certain precautions are used

Di-Syston*	Phosdrin*[1]	TEPP*
Malathion[1]	Sabadilla	Thimet*

Group 3

Moderately toxic materials that can be used around bees if timing and dosage are correct, but should not be applied directly on the bees in the field or at the colonies

Chlorobenzilate	DDT	Korlan	Thiodan[1]
Co-Ral	Endrin[1]	Perthane	Toxaphene[1]
Cryolite	Ethion (Nialate)[1]	Tartar Emetic	Trithion
DDD (TDE)	Isodrin	Tedion	

Group 4

Relatively nontoxic materials that can be used around bees

Allethrin	Dilan	Methoxychlor	Ryania
Aramite	DMC	Mitox	Sulfur
Bordeaux Mixture	DNOCHP (DN-111)	Monuron (CMU)	Sulphenone
Captan[1]	Dylox (Dipterex)[1]	Nabam[1]	Systox (Demeton)*[1]
Copper Oxychloride Sulfate	Ferbam[1]	Neotran	Thiram[1]
Copper Sulfate (Monohydrated)	Genite 923	Nicotine	Zineb[1]
Cuprous Oxide[1]	IPC[2]	OMPA	Ziram[1]
Cumilate	Karathane	Ovex (Ovotran)	2,4-D*[2]
Delnav[1]	Kelthane	Phostex	2,4,5-T*[2]
	Maneb[1]	Pyrethrins	
	MCP[2]	Rotenone	

* Permit required by State regulation for most uses of these materials. Permit for 2,4-D and 2,4,5-T as weed treatments but not as hormone sprays on citrus.

[1] These materials field and laboratory tested; all others just laboratory tested. Further field testing may change the group location of some of the materials.

[2] Data obtained from other research workers.

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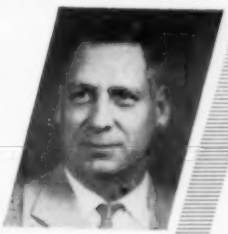


By Kelvin Dorward

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Survey & Detection Operations, Plant Pest Control Division, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in U.S.D.A.'s pest surveys throughout the U.S.

Cotton Insects Increasing

THRIPS were perhaps the most damaging cotton insects during late May. They were extremely heavy in central Alabama, and damage was apparent in older cotton in the Mississippi Delta section. Damage was severe in untreated Madison Parish, Louisiana, fields and was becoming general in McLennan and Falls Counties, Texas. Infestations were on the increase in many acres of Texas. Cotton was being damaged by thrips in several New Mexico counties, the San Joaquin Valley of California and heavy populations were reported from areas in Cochise, Maricopa and Pinal Counties, Arizona.

Although generally light, cotton boll weevils were found throughout the southern portion of the Cotton Belt. Some damage was reported by late May from areas in the lower Rio Grande Valley of Texas. Reports for the week of May 22 showed a weevil population of 72 per acre in McLennan and Falls Counties, Texas, compared with 138 for the same period in 1958. Populations of the insect were light in Tensas and Franklin Parishes, Louisiana, ranging from 0-152 per acre. In the Delta area of Mississippi, counts ranged from 0-50 per acre, with only 2 fields of 20 examined being infested.

Boll weevil emergence by late May was rather general throughout central Alabama, with counts of 150 per acre being recorded in Sumter County, 350 in Hale County and 200 in Tuscaloosa County. Weevils were found in all cotton fields examined in the Florence, South Carolina, area and many buds were being cut. Counts averaged 31 weevils per acre.

Fleahoppers and aphids on cotton were light from most areas reporting. The exception was Hale County, Alabama, where aphids were heavy from the lower Rio Grande Valley of Texas and there was an unusually early buildup in the Imperial Valley, Imperial County, California. Cutworms caused sufficient damage in some California cotton fields to require replanting. These insects also caused some damage in Texas, Missouri and Tennessee.

Grasshopper Hatch Light

Although some trouble spots were beginning to show by late May, the grasshopper hatch in general was relatively light. The most activity was reported from New Mexico where spraying for grasshoppers was underway in Curry County. Infestations were heavy on about half of the grassland in Roosevelt County and in irrigated areas, margins and high pastures in Rio Arriba County. Grasshopper nymphs were sufficiently heavy along ditch banks in Mesa County, Colorado, to warrant control measures being advised. Counts ranging from 5-15 nymphs per square yard were reported from margins in Larimer County, but none were observed on range.

Hatching was well underway in several Utah counties and controls were being applied locally in Piute, Carbon and Emery Counties. Nymphal surveys made in Texas Panhandle counties during late May showed populations much lower than for the same period last season. It appeared that only small localized areas would be treated, in contrast to the large scale control program of 1958. Nymphal counts ranging from 15-25 per square yard were reported from 30,000 acres of rangeland southeast of Cheyenne, Roger Mills County, Oklahoma. Counts up to 50 per square yard in cropland were reported in Dewey County. Nymphs were found in field margins and most fields of central and western Kansas by late May. The highest count was over 300 per square yard in Phillips County. In general, though, counts varied from less than 1 to over 50 per square yard. Populations in Arizona were generally light, with the heaviest reported being 20 per square yard in local areas of Yavapai County.

By the latter part of May, grasshopper hatching was well underway in southeast Illinois and nymphs were abundant along alfalfa field margins. Few nymphs were reported from Wisconsin, Indiana, Wyoming, Idaho and Oregon.

Spittlebug Over Wide Area

The meadow spittlebug was prevalent over a wide area by the latter part of May. The insect was found throughout Maryland and Delaware and heavy populations were recorded on alfalfa and clover in southwestern Virginia. Spittlebug nymphs were reported from New York, Massachusetts, Michigan and Wisconsin by early May. By late May the insect was in out-

break proportions in eastern Indiana, with counts highest on record for the area. In the northeastern part of the State the average count was as high as 500 per 100 stems and one field in the southeastern area averaged 950 per 100 stems. Counts in the western part of Indiana were much lower, averaging 75-100 per 100 stems.

Spittlebug populations in northern Illinois had decreased an estimated 50 percent by late May but nymphal counts were still 75-200 per 100 stems. In northwestern Illinois counts up to 400 per 100 stems were recorded. Heavy populations of the insect on grasses were found in the Richardson Grove area of Humboldt County, California, but low counts were reported from Nez Perce County, Idaho.

Corn Borer Heavy in N. J.

The early May European corn borer populations in New Jersey were generally higher than those in 1958 and the damage outlook had increased. Infestation outlook for potatoes and tomatoes was the second highest in 5 years. During the same period, emergence was underway on the Eastern Shore of Maryland and in Delaware. In Virginia egg masses were hatching on the Eastern Shore by May 12. By the latter part of May adult emergence was 100 percent in Poinsett County, Arkansas, but no eggs had been found on corn in the area. In northern Alabama a few egg masses were being deposited on older corn. European corn borer adult emergence was 4 percent in southern Illinois by the middle of May. Pupation was underway in all areas of the State except the northern section. Emergence had begun in southeastern Missouri but pupation had not started in the northern part. By late May pupation was 20-30 percent in Pottawatomie County, Kansas, but no pupation had been reported from Minnesota or Wisconsin.

Miscellaneous Insect Activity

Among the fruit insects active in May, heavy populations of mites were reported from Massachusetts and were becoming troublesome in some Maryland apple orchards. Heavy populations were recorded from unsprayed orchards in several New Mexico counties. Mites were building up on English walnuts in the San Jose area of Santa Clara County, California, by late May. Aphids were reported as heavy on various fruit trees from localized areas of Missouri, New Mexico, Utah, California and Idaho.

Colorado potato beetle was becoming abundant on potatoes and tomatoes in Delaware, Maryland, Virginia and New Jersey by late May.

The XIX brood of the thirteen-year-variety of the periodical cicada emerged during May over a wide area. States reporting the cicada during the month were Mississippi, Alabama, Georgia, Tennessee, North and South Carolina, Virginia, Missouri, Indiana and

(*Continued on Page* 84)

LISTENING POST

By Paul Miller

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Mycology and Plant Disease Reporting Section, Plant Protection Research Branch, United States Department of Agriculture, Beltsville, Maryland.

Results Of Tests To Control Potato Rot Nematode In Wisconsin

H. M. Darling[1], of the University of Wisconsin, writes that quarantine regulations enforced by the Wisconsin State Department of Agriculture prohibit the growing of potatoes in the restricted area infested by the potato rot nematode, *Ditylenchus destructor*. He reports results of experiments planned to find a nematocide capable of providing complete control of this nematode and suitable for use under Wisconsin conditions.

General Methods:

The presence of the nematode in Wisconsin was discovered in 1953 and control experiments were started in the spring of 1954. Plots were established on land observed to be heavily infested in 1953. Of the four nematocides tested, ethylene dibromide (EDB) gave best results. Dr. Darling's discussion refers mostly to it. The formulation used was Dow Chemical Company's Dowfume W-85.

The materials tested were all applied as liquids by weed-spraying machinery mounted on a tractor. Equipment included gear pump, pressure and flow regulators, tank, suction hose, and enough leads arranged so as to deliver the liquid to the plow sole or to the rear of chisel teeth.

Spray nozzles applied the chemicals to the plow sole in bands about 8 inches wide. Operation pressure was about 40 pounds and tractor speed 3 miles per hour. Rate of application was calibrated by the size of the discs used in the flow regulators. For rapid sealing of treated soil, an 8-foot spike-tooth drag was attached to the plow in an offset position, so that as each furrow was treated the drag overlapped the two previously treated furrows. The treated areas thus were actually dragged three times. Except as noted, total dosage was at the rate of 6 gallons per acre, one application at 4 and a second at 2 gallons per acre.

Treatments were made when temperature of the soil at the 8-inch depth was between 50° and 80°F and moisture content equalled that of a seed-bed in good condition for planting potatoes. Except on large plots where the second application was made at right angles to the first, plowing for both applications was in one direction.

At harvest time yields were recorded and tubers were examined for signs of nematode infection. Random samples from each plot were stored for later examination.

Experiments and Results:

In 1954 the four nematocides tested were applied in individual four-row plots, 12 × 110 feet, on heavily infested land. Split applications, by chisel and plow or plow alone, were made first on May 22 and finished 12 to 14 days later. Planting was completed on June 20. Standard potato-growing practices were followed throughout the season. Records were taken from the two center rows of each of four replications.

Toxicity was evident for all treatments during the summer. Vines in the treated plots were as much as 12 inches shorter than in the untreated check by midseason. Yields also showed effects of toxicity. Yield per acre in the check was as much as 285 bushels, whereas in one treated plot that received an excessive dosage it was only 20 bushels.

At harvest not a single infected tuber was found in the plots treated with EDB. Varying amounts of infection appeared in plots treated with each of the other nematocides tested. Infection in the check ranged from one infected tuber in one replicate to 86 in another. This range of infection in the untreated check indicated that infestation in the experimental location varied considerably.

The entire experimental location was replanted in 1955 and 1956, without further treatment. In 1955 no residual toxic effect from any of the nematocides applied in 1954 was apparent, and yields on the treated plots did not differ significantly from yields on the check plots. One infected tuber was found in each of two EDB-treated replicates negative in 1954. In 1956 nematode infestation throughout the experimental location was considerably less than in 1955. However, in one check plot

(*Continued on Page* 85)

[1]H. M. Darling, "Control of the potato rot nematode in Wisconsin," *Plant Disease Reporter*, vol. 43, no. 2, pages 239-242. Feb. 15, 1959.

Aerial Crop Spraying and Dusting Costs Estimated

THE typical hourly cost of dusting or spraying crops from a 150-horsepower, two-seated plane is estimated to be $28.88, if the applicator uses his plane for 200 hours of flying time annually, and $24.14 if his flying time is 400 hours annually, a U. S. Department of Agriculture economist reports.

Melvin R. Janssen of USDA's Agricultural Research Service, who has been studying the cost of using aircraft as a farming aid, says hourly outlays for a 200-hour-a-year operator include $12.02 fixed costs and $16.86 for variable costs. The figures represent averages from information furnished by a number of aerial applicators.

The $12.02 hourly in fixed costs includes $8.36 for equipment depreciation; $1.02 for taxes; $2.04 for interest; and $.60 for hangar rental. The $16.86 in variable costs includes $3.75 for fuel and oil; $5 for the pilot; $4.15 for regular maintenance and damage; $3.50 for the ground crew; and $.46 for liability insurance.

If the applicator can expand to 400 hours of work a year his fixed costs would be: $1.12 for depreciation; $.51 for taxes; $1.02 for interest and $.30 for hangar rental. The per hour costs for such variables as fuel and oil, the pilot and maintenance and damage are the same as those for 200 hours of operation, but ground crew costs drop from $3.50 hourly to $3.00, liability costs from $.46 to $.29.

Costs per hour can be translated into cost per acre, but allowance must be made for such variables as ferry time between airfields, lost time from airfield to job, and differences in rates of application of the material being released, which may be seed, fertilizer, or pesticides.

One example, provided by an operator who dusted and sprayed 26,000 acres in Texas and had 380 hours of plane time, broke down as follows:

Total per acre cost for 26,000 acres was 36.3 cents, of which variable costs per acre totaled 24.1 cents, and fixed costs were 12.2 cents. If this operator had covered only 13,000 acres, Dr. Janssen estimates his fixed costs would have been 18.5 cents, and total costs 42.6 cents, an acre.

Dr. Janssen, a USDA economist, is assigned to the Indiana Agricultural Experiment Station at Lafayette, Ind.

•

Heptachlor Refresher Course

The Velsicol Chemical Corp., Chicago, is offering a sales aid called the Heptachlor Salesman Insect Control Refresher Course. The course was designed primarily to educate dealers on all phases of insecticides and insect control. It is available from the company.

The course is described in detail elsewhere in this issue. (see story beginning on page 36)

75,000 Acres Treated in '59 Gypsy Moth Program

APPROXIMATELY 75,000 acres of timber were treated for gypsy moth in Otsego and Delaware Counties, New York, in a spray program that began May 21 and was completed June 11.

Operations and headquarters for the program were located at the Cooperstown-Westville Airport, a 2,300 foot sod strip near Westville, N. Y. The spraying was conducted by the U. S. Department of Agriculture in cooperation with the New York Department of Agriculture and Markets. Assisting in the program were the N. Y. Department of Conservation and the College of Agriculture at Cornell University.

Edgar Eckess, district supervisor of the USDA Plant Pest Control Division, and A. Geiser were in charge of the operation. Ueding Flying Service, Vincennes, Ind., contractor for the spraying, furnished four 450 HP Stearman sprayers which were used to spray smaller areas, fence rows, and touch up around lakes and other areas. Two TBM aircraft, converted World War II torpedo bombers, were furnished by a sub-contractor, Red River Aero Dusting Co., Texarkana, Arkansas. The TBM's were used to spray the large areas.

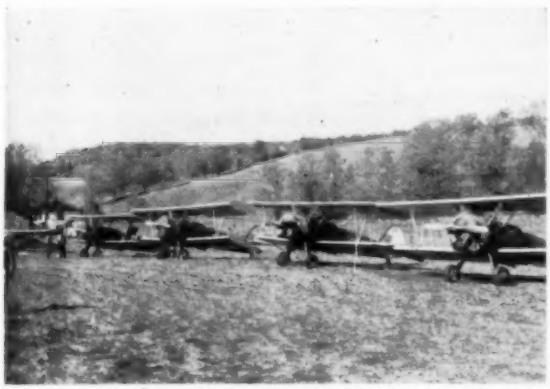
The material used for the job was Union Carbide's Sevin, suspended in fuel oil. One and one-half pounds of an 85 per cent material was mixed with fuel oil and paraffin to give a finished mix of one gallon containing one and one-quarter pounds of actual Sevin. The spray was applied at the rate of one gallon per acre. The chemical contractor for the project was United Heckathorn, Richmond, Calif.

The fuel oil and paraffin was stored in a 20,000 gallon tank and the materials were mixed in a 1,600 gallon mixing tank right at the job site. The finished mix was stored in a 10,000 gallon storage tank where it was agitated by air 24 hours a day.

All areas to be treated were scouted by ground personnel. Bait ponds, poultry farms, bees, truck farms, lakes, and other such areas were marked on the pilots' maps and particular attention was paid to avoid spraying or contaminating these areas. Tycoons, small balloons filled with helium, and flares were used in guiding the pilots.

Ground crews remained in constant contact with headquarters by radio throughout the project to insure that all components of the operation; headquarters, observation planes, and spray pilots; were kept advised of wind and weather conditions in their particular area. Except for some slight delays due to fog, work was started at dawn each day and lasted until the wind became too strong or the temperature became too high.

Two USDA Cessna 180's and one Cessna 182, furnished by Ueding Flying Service, were used to observe and direct all spraying from above. These planes maintained constant radio contact with headquarters so that a complete picture of the operation was available at all times. Following the completion of actual spraying, traps to attract male moths were systematically placed throughout the counties involved to determine the effectiveness of the spray program.



Four Stearmans and two TBM aircraft were used in the May 21-June 11 gypsy moth spray program in New York counties.

•

Grumman Ag-Cat Delivered

Charles Sellers, left, takes delivery of a Grumman Ag-Cat at Hayti, Mo., from Richard Reade, president, and

L. W. Mooneyhan, sales manager, of Mid-Continent Aerial Sprayers, Inc., distributor. Mr. Sellers is vice president of Sellers Aviation, Inc., Ag-Cat Division, Wakeeney, Kans., and Bakersfield, Calif.

The first Ag-Cat was delivered in May to Alden E. Robinson of Accord, N. Y. Mr. Robinson has reported that he is able to spray 41 per cent more acreage per hour, using 52 per cent less fuel, than with his previous airplane. This work was done on apple orchards in New York.

•

Bombers To Fight Fire

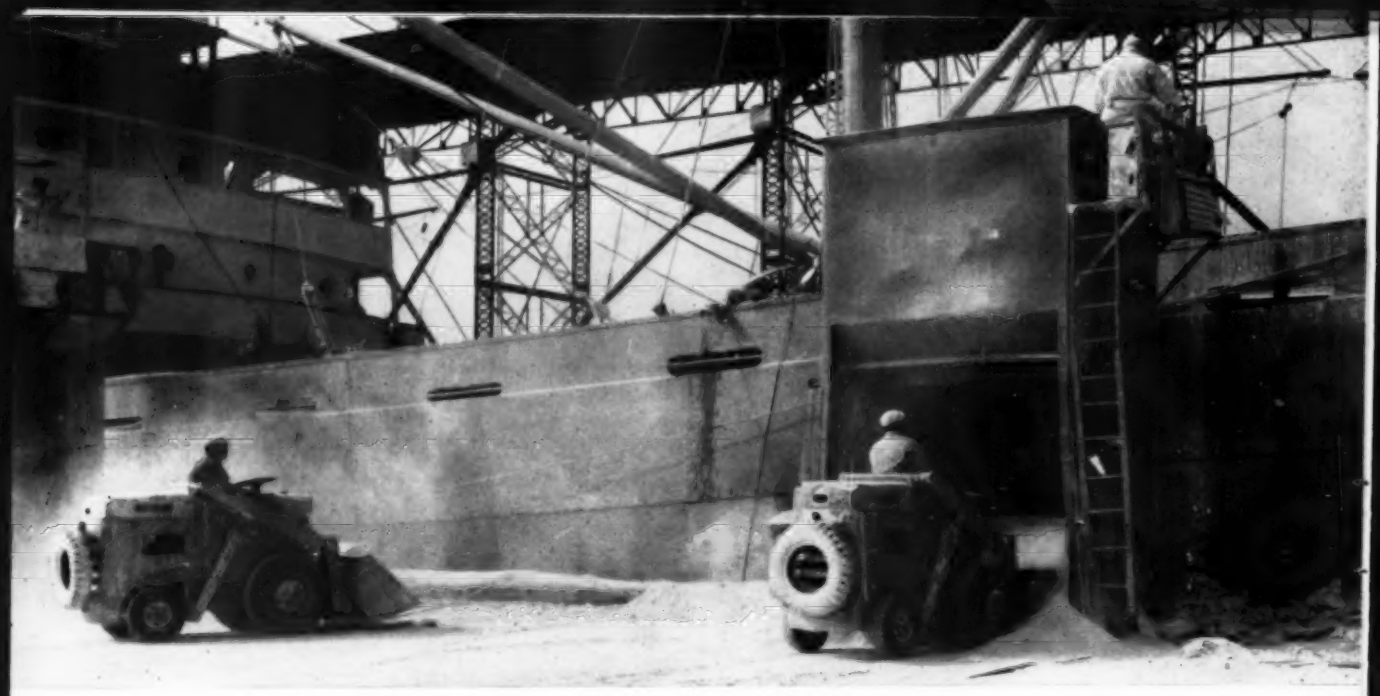
Six surplus Navy bombers will be used by the U.S. Forest Service in Montana this summer to fight forest fires. The planes, old Grumman Avengers, are being equipped with 1,000-gallon tanks to carry borate solution which will be dumped on flaming trees.

This fire-retardant was used experimentally on a large scale last August when the Forest Service assisted the National Park Service in putting out a 2,200-acre nine-day fire in Glacier National Park. Besides quenching flames, the borate solution coats trees and shrubbery in the path of a fire, thus checking its spread.

•

New Leader Distributor

Power Brakes & Equipment, Inc., St. Paul, Minn., has been appointed a distributor for the Highway Equipment Co., Cedar Rapids, Iowa. They will handle Highway's complete line of spreaders.



From ship to train or shoreside storage . . .

TWO MILLION POUNDS OF BULK MATERIAL

handled daily by 8 Michigan Tractor Shovels

On Philadelphia's waterfront, eight high-speed tractor shovels are moving the amazing total of two million pounds of bulk material *every 8 hour shift!*

The machines are 16 cubic foot Model 12B Michigans. Their job, for Independent Pier Co., is to transfer England-imported china clay from temporary shipside hoppers to waiting rail cars and storage bins. Despite the high-volume output, it's not an easy assignment. Material, when disturbed, rises in choking clouds of dust, quickly covering men and machines. Loads must be moved through traffic 60 *to 900 feet*. And all work has to be done quickly to minimize high dock charges.

Under these pressures, Independent Pier has developed probably the fastest operation of its type along the waterfront—built around the speed and mobility of the eight Michigans.

Load-unload cycle averages 58 seconds

Approaching the hopper head-on, bucket skimming the dock, a Michigan in typical operation thrusts into the heaped clay. With flick of tilt-action lever, operator brings up his pay-load. No time is lost in repeated bucking; Michigan's pry-out action heaps bucket in a few seconds. At same instant, a flip of the forward-reverse lever backs the Michigan out of the hopper in a fast, tight turn. In "forward" again, the Michigan races for a boxcar, barely slowing to turn in—even through narrow six-foot doors. To heap

the clay as high as possible in either end of the car, the Michigan charges up the slope as if it were a hill. At top, operator simultaneously dumps bucket and power-shifts into reverse; the Model 12B backs down and swings out the door, ready to repeat the cycle. Operating at top speed through thick dust fog, over round trip haul cycles of 120 to 1800 feet, the Michigans have established a load-unload average of only 58 seconds!

Maintenance, new operators no problem

"Maintenance-wise" says master mechanic Mike Snowden Jr, "there's no comparison between these Michigans and other equipment. They not only need a lot less attention, they're much easier to service. A quick check at lunchtime—mainly knocking dust out of air filters—keeps them in top shape. Ruggedness and ease of operation are advantages, too. Hiring new stevedores every day means new operators for the Michigans —and *could* cause trouble. But new men learn fast on those simplified controls. They don't have to fight a clutch, either, and power steering is a big help pushing around in that clay."

Find out how Michigan ease of handling, speed and dependability can help *you*. Write us any time for complete details . . . or, better still, to arrange a no-obligation demonstration on your job.

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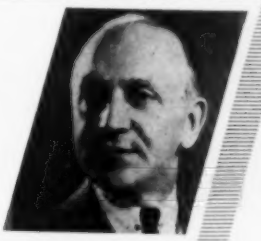
Fertilizer Views and News



By Vincent Sauchelli

Dr. Sauchelli is Chemical Technologist for National Plant Food Institute.

Fertilizers and Health Values to Be Studied

CONNECTICUT Senate Bill No. 561, approved this spring, provides: The sum of $10,000 be appropriated annually to the Connecticut Agricultural Experiment Station for the employment of a scientist to conduct basic quality research on fruits and vegetables grown in Connecticut. This would include research concerning the effects of climate, water, organic matter, sprays, fertilizers and other environmental factors on quality, edibility and health value to consumers.

Statement of purpose: The effect of climate, organic matter, water, fertilizer, sprays and environmental conditions are highly important but little understood factors in the quality of fruits and vegetables. What is needed is basic research. Most tax supported research in plant science is aimed at increasing the efficiency of food production. This results in cheaper food for the consumer. The research proposed here will be aimed at improving the quality. This should result in better food for the consumer. As an additional value, the knowledge gained will be useful to all who work with plants, whether they be trees, fruits, vegetables or flowers.

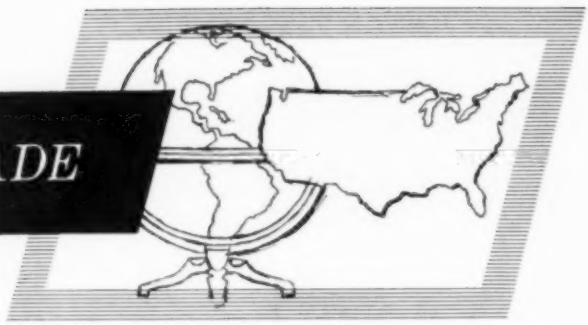
This action of the Connecticut legislature is, to say the least, most welcome and refreshing. The thinking behind it reveals confidence in the scientific method. The problem is immensely complicated. Quality, edibility and health value of foods depend upon a large, intricate mass of interrelated genetic and environmental factors. For one scientist—as the bill provides—to study the effects of climate, water, organic matter, fertilizer, pesticide sprays and soil variables on the health-giving qualities of food crops is, perhaps, asking for the impossible. However, the selectee will undoubtedly have the cooperation of the scientists at the local experiment station. Whatever the means, the significant thing, to me at least, in this bit of legislation is the recognition of the importance of getting maximum quality as well as quantity in our farm crops and the provision of a special fund for this exclusive project.

Directly or indirectly we depend upon the so-called higher plants for most of our nutrition. The nutritive value of such plants is the resultant of genetic and environmental variables. Fertilizer is only one of the many influences which affect such value. Light, water, climate, soil have much to do with the ultimate composition of the plant. To isolate and evaluate the respective effects of each major factor on the ultimate nutritional quality of the food crop is a bewilderingly difficult problem.

Insofar as the fertilizer factor is concerned, a considerable body of research data has already been accumulated. This information indicates quite definitely that soil fertility can and does influence the nutritive value of food and feed crops. Chemical fertilizers applied to soils either to correct plant food deficiencies or increase the level of soil fertility serve to build up the nutritive value of crops, despite the contentions of certain "pro-humus advocates." Dr. C. H. Mahoney, an outstanding horticultural authority, after reviewing a great accumulation of field and greenhouse experimental data in 1950, reported to the American Society of Agronomy that the evidence strongly refuted the allegation that chemical fertilizers reduce the nutritive value of fruits and vegetables grown for human consumption. He pointed out that high yields and high quality of such food crops need an ample, balanced supply of plant nutrients in the soil. Furthermore, he declared that it is immaterial to the plant whether these nutrients are supplied by organic or inorganic sources. Many authorities in all the countries of the world have published the results of their investigations on this problem of how nutritive value may be influenced by environmental factors. The general consensus is that chemical fertilizers can be regarded as a favorable factor in the improvement of nutritional quality and in increasing the quantity of our food crops.

Although such favorable evidence is substantial, it must be admitted the data are still fragmentary. However, enough evidence exists showing the effects of fertilizer, light, water, and soil to support the purpose of the Connecticut legislation. That effort will certainly not be a waste of time and money. It is to be hoped that other state legislatures will emulate the progressive attitude of Connecticut.★★

NEWS about the TRADE



IMC Consolidates Divisions

The International Minerals & Chemical Corp., Skokie, Ill., has effected a realignment of its principal product divisions. The change, effective July 1, consolidates three divisions into an Agricultural Chemicals Division in which fertilizer materials salesmen will handle IMC's full line. Previously, each materials division had a separate sales force.

L. W. Gopp

D. J. Stark

Two new vice presidents in the Agricultural Chemicals Division are Leonard W. Gopp in charge of sales and David J. Stark, operations. Mr. Gopp formerly was general sales manager for IMC phosphate chemicals and Mr. Stark joined IMC from the Escambia Chemical Corp., where he was vice president and production manager.

•

Ma-Hydrazide Demonstrations

A series of field demonstrations to show tobacco growers how to use maleic hydrazide in controlling growth of tobacco suckers has been scheduled by the Naugatuck Chemical Division of U. S. Rubber Co. Naugatuck will detail six men to handle a series of thirty to forty lectures and demonstrations.

Formulators who specialize in sale of finished products based on maleic hydrazide will hold an additional sixty sessions for dealers, growers, county agents, extension personnel, etc.

The substantially stepped-up educational program follows an unsuccessful effort by tobacco buyers and cigarette manufacturers to get the North Carolina legislature to pass a law banning use of M-H on tobacco. Many tobacco buyers had contended that the use of maleic hydrazide resulted in the production of low quality tobacco leaf. Naugatuck holds that only misuse of the product would produce any such result. In the current program of demonstrations it is emphasized that over-heavy applications of M-H or too-early harvesting of the tobacco should be avoided.

Last season approximately one-fifth of the total tobacco acreage was treated, with some 450,000 lbs. of maleic hydrazide being applied on 200,000 acres.

•

Buy Port Maitland Plant

The Electric Reduction Co. of Canada has purchased the chemical fertilizer plant of Dominion Fertilizers Ltd. at Port Maitland, Ont.

The operation of the plant, which produces phosphatic fertilizers, will be linked with a chemical project that Electric Reduction is planning for the Port Maitland area.

•

Ronnel For Livestock Pests

Ronnel, an organic phosphorus chemical, has been added to the list of insecticides recommended by the U. S. Department of Agriculture for the control of several livestock pests. It is available in several forms: as a spray, a smear, and as a pill.

The chemical name of the active ingredient is 0,0-dimethyl 0-2,4,5-trichlorophenyl phosphorothioate. Korlan is the name applied to the technical grade of ronnel. It formerly was known as ET-57.

Baughman Purchases Plant

The Baughman Manufacturing Co., Jerseyville, Ill., has purchased a former International Shoe Company plant in Jerseyville. The added plant will be used for fabrication of parts and smaller products assembly.

•

Symposium on Resistance

A symposium on "Research Progress in Insect Susceptibility to Pesticides" will be held October 7-8, 1959 at the Hotel Mayflower, Washington, D. C. It will be sponsored jointly by the National Agricultural Chemicals Association and the Entomological Society of America. Dr. R. L. Metcalf of the Univ. of California will be the symposium chairman.

The sponsors intend that this symposium shall be pointed along constructive lines, toward solution of the pesticide resistance problem. It is hoped that new material, new data and new ideas will be developed by those participating.

•

Appointed By Chase

The Chase Bag Co., New York, has appointed Eugene P. Alexander (left) as sales manager of its Paper Bag Division, with headquarters in New York. He had been manager of the Chase Bag Company sales office in Chicago since 1957.

William J. Gosney, (right) a sales representative for Chase in Chicago since 1956, succeeds Mr. Alexander as manager of that office. He has been with the firm for ten years.

Pacific ESA at Sacramento

Some 350 entomologists were expected to meet at the 43rd annual meeting of the Pacific Branch, Entomological Society of America. The convention was scheduled for June 22-24 at the Hotel Senator, Sacramento, Calif.

•

Fertilizer Safety School

Elmer Perrine, Allied Chemical & Dye Corp., New York, will discuss the handling of liquid materials in the fertilizer mixing program at a fertilizer safety school, Aug. 12 and 13, at Cornell University, Ithaca, N. Y. The school is sponsored by the Fertilizer Section of the National Safety Council with the cooperation of the National Plant Food Institute.

Among other speakers will be: Ed O. Burroughs Jr., F. S. Royster Guano Co.; and George Dietz, Fertilizer Manufacturing Cooperative, Baltimore.

•

V-C Florida Plant On Strike

A strike has closed the Virginia-Carolina Chemical Corp.'s plant in Nichols, Fla., despite the company's willingness to settle for a 10½¢ per hour wage package.

The striker's grievances stem from company proposals to switch union dues check-off authorization from a yearly to a monthly basis, and to withdraw from the contract a union recognition clause which reportedly is at odds with Florida's right-to-work law. The strike threatens to be a lengthy one, according to some reports.

•

Lilly Research Center

Eli Lilly and Co., Indianapolis, Ind., formally dedicated its new research center for agricultural sciences near Greenfield, Ind., June 16, in ceremonies that were attended by some 350 representatives of science, business, and government.

Among the speakers was Dr. Byron T. Shaw, administrator of the USDA's agricultural research service, who said that the center is a "valuable addition to our total national facilities for agricultural research, from which the entire country benefits."

•

Cyanamid Research Director

Dr. E. L. R. Stokstad has been appointed director of research for the American Cyanamid Co.'s Agricultural Division. He has been with Cyanamid since 1941.

Dr. Stokstad, who had been director of the animal science research department, was the first scientist to establish the growth-promoting effect of antibiotics on animals.

•

Cotton Insects In Russia

In a report on cotton in Russia, prepared by Leonard A. Mobley of the National Cotton Council's Foreign Trade Division, a section on insects and controls states that, despite the latitude and cold winters, Russia has serious insect problems.

Insecticides are used in large quantities, but are mostly older, standard types. The chlorinated hydrocarbons are not widely used. Collective farms either have an entomologist on the staff or available from a tractor repair station. He decides when control measures are needed. The state provides the service and insecticides, which generally are applied by air.

Safety Award To Raymond Bag

The manufacturing plant of the Raymond Bag Co. at Middletown, Ohio, has received a special safety award from the company for compiling a top safety record. Their accident rate was less than one-third the average for the overall bag industry.

•

2½M Pesticide Research Bill

June 21, Washington, D.C.—The U. S. Department of Interior today announced endorsement of legislation which it said would greatly increase the scope and value of research being conducted on the effects of pesticides on wildlife, fish, etc.

The proposed legislation (H.R. 5813 or S.1575) would raise the authorization to $2,565,000.

The original appropriation for P.L. 85-582 (*Agricultural Chemicals* p. 33, Sept., 1958), authorized $280,000 to be appropriated for the studies.

•

Dr. J. H. Hibben Dies

Dr. James H. Hibben, chief of the chemical division of the U. S. Tariff Commission, and one of the foremost chemical consultants in the country, died June 15 of head injuries in Washington, D. C., after a fall at his home. He was 62 years old.

Processing Fertilizers to be Theme of Round Table

THE annual meeting of the Fertilizer Industry Round Table, scheduled for November 4-6, 1959 at the Mayflower Hotel, Washington, D. C., will feature discussions on practical problems in processing fertilizers.

A review of the manufacture of conventional mixed fertilizers will include reports on: the mechanical condition of the fertilizer; a study of segregation causes; effects of particle size of the raw materials and the mixing technique.

Current plans for the program include a report on a small, low-cost chemical laboratory for the fertilizer manufacturer, equipped to provide much needed rapid control data. The importance of quality control is still another subject which will be studied.

Programs in previous years have emphasized manufacturing techniques in ammoniation and granulation of fertilizer.—A feature of the 1959 meeting will be a report on developments in the manufacture of semi-granular mixtures.

As in previous years, several industry experts will be invited to discuss specific topics, following which open participation, by all members will offer opportunity to deal with individual questions and comments on member experiences.

The program is being prepared by the executive committee: Vincent Sauchelli, H. L. Marshall, J. Reynolds, and A. Spillman.

What price weed control?

For 25 cents you can buy enough OLDBURY sodium chlorate to treat about 100 square feet of weed-infested land.

That's a bargain. There's no other way to stamp out weed and grass infestation so cheaply and lastingly.

You need no expensive equipment. There are no costly ingredients to add. OLDBURY sodium chlorate goes on dry—or dissolves easily in water.

One treatment does the job, as a rule; quickly kills perennial weed and grass top growth; destroys germinating seeds as well as growing roots. The sterilant effect lasts one to two years in heavy soils; up to a year in sandy soils.

Low cost is today's No. 1 reason why OLDBURY sodium chlorate is your best choice for spot control in crops, and for general control on ditch banks, canals, headlands, along fence rows and roadsides.

Full-time Hooker agronomists can help you plan weed control programs and can advise you on handling, storage, and application of sodium chlorate. You get fast delivery direct from the nation's leading producer with plants at Niagara Falls, N. Y., and Columbus, Miss. OLDBURY sodium chlorate, 99% pure, is shipped in steel drums, 100 and 450 lbs. net.

For further information and prices, write today for bulletin.

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Gen. Chem. Names Five

The General Chemical Division of Allied Chemical Corp., New York, has increased its agricultural chemicals sales staff with the addition of five men assigned as resident salesmen. The men will be primarily responsible for the introduction of new Allied Chemical products, including Urox herbicide for non-crop areas; Genite miticide; and Plyac, a polyethylene type spreader-sticker for addition to pesticide sprays.

Walter P. Kerr is resident representative in Omaha, Nebr John Magliocco covers Long Island, northern New Jersey and eastern New York. William D. Thomas is assigned to Shreveport, La., to serve northern and central Louisiana and northeast Texas.

Also named by General Chemical were Rogna M. Burnett, assigned to the Houston, Texas, office; and F. H. Stillwagen, assigned to South Bend, Ind., to cover Indiana and Kentucky.

•

Foliar Feeding Cotton

The Hayes-Sammons Chemical Co., Mission, Texas, has introduced a spray-fertilizer, Fol-Tron, under the firm's Mission Brand label, for use on cotton.

The company reports that Fol-Tron, in diluted form, can be sprayed by plane or from a conventional spray rig to feed plants through the leaves. In addition, Hayes-Sammons said, it can be mixed with any standard insecticide and both processes accomplished with one spraying.

•

Conspiracy Action Concluded

A settlement has been reached between the Mitchell Cotts Group Ltd. and the Pyrethrum Board of Kenya and Society Co-operative Des Produits Agricoles on a conspiracy action for breach of contract brought by Mitchell Cotts. The joint defendants are reported to have agreed to submit to judgment for damages of £40,000, plus costs.

J. K. Dick, a managing director of Mitchell Cotts, said that his company's purpose in bringing the action was to establish its right to fulfillment of a commercial contract, freely entered into by a statutory board.

•

Heads European Office

Dr. Joseph Benedict has been appointed European technical representative for the Stauffer Chemical Co., New York. He is headquartered at Stauffer's new European office at 30 Rue du Rhone, Geneva, Switzerland.

To Buy Israeli Firm

A group of American investors, headed by industrialist Samuel Rothburg, has announced plans to buy Fertilizers & Chemicals Ltd., Israel's largest chemical firm—now government owned.

The group, Israel Investors Corp., will purchase $2 million in F&C stock during the next two years and then will receive an option to buy the government's share in the company. The investment will total $12 million.

Marketing Pesticides Thru Pest Control Operators

AT the meeting of Pest Control Operators (January, 1959, in Purdue, Ind.), William K. Kelaplane Jr., Illinois Pest Control Co., outlined the possibilities of adding income for PCO's by operating a retail store, and selling pesticides on a retail level.

"Last year," he said, "was the 15th year we've had a retail store in our 20 years of business. It lost us money the first three years, and slightly more than broke even the fourth year. It took us the fifth and sixth years, even though the store made a profit in each of those years, to make up the losses of the first three years."

Mr. Kelaplane reported that of the pest control operators who do have retail stores, very few exceed 10 per cent of their gross income from retail sales. In 1958, Illini Pest Control Co., had gross retail sales exceeding $26,000, on which they netted 19.3% of sales. This profit resulted after all direct expenses (salaries, rent, depreciation, etc.,) had been deducted. Profits can be improved, he reported, by good inventory control, credit management, etc. As to the products sold, Mr. Kelaplane indicated that 65 per cent of the total retail sales were garden and lawn and fruit tree insecticides; 22½ per cent included household and garden sprayers and dusters, small tools, pot supplies, peat moss and weed killers. "Up to this point," he said, "we sell very little to the farm trade, other than small packaged lines. Less than five per cent of our sales were oil formulations of dieldrin and chlordane for household use. There might be some interesting conclusions from this last item, but for the purposes of this presentation, I'll limit them to the possibilities that the public is not buying all they need, and that both our retail sales and special jobs could be measurably increased with proper advertising.

"Specifically, we sell materials for ant, grub and chigger control in lawns, packaged flower and vegetable garden sprays and dusts, mothproofing sprays, flakes and balls, sprays and dusts for fruit and shade trees, repellents, including repellents for mice and rabbits for use both in orchards and in the city to protect flowers and gardens, liquid and dry fertilizers for lawns and flower and vegetable gardens," (and other products). "We also repair household sprayers and rent sprayers, seeders, rollers and spreaders."

Mr. Kelaplane indicated that a new store (in an area drawing on 30,000 population) might expect a gross of about $5,000 the first year, $10,000 the second, and $15,000 the third. "It took us seven years to reach a $20,000 gross and we have leveled off the past four years."

Mr. Kelaplane cited estimates that the pesticide market may be at least one billion dollars by 1975.

Armour Buys Nitrogen Plant

Armour and Co., Chicago, has purchased the nitrogen plant of the Mississippi River Fuel Corp. near Festus, Missouri. The plant now produces approximately 240 tons per day of anhydrous ammonia.

In a concurrent move, Armour announced the formation of the Armour Agricultural Chemical Co., Atlanta, Ga., as a division of Armour and Co. It will include the Armour fertilizer, nitrogen, and phosphate divisions, and is expected to enable the company to enter the field of direct application and high analysis fertilizers, it was announced.

•

Directs Chemical Sales

Charles P. Berdell has been appointed director of chemical sales for the National Aniline Division, Allied Chemical Corp., New York. For the past five years, Mr. Berdell has been the manager of sales for Baker & Adamson laboratory reagent and fine chemicals for Allied Chemical's General Chemical Division.

•

Agrico Starts Construction

Construction was started last month on a fertilizer plant at Sleepy Eye, Minnesota. The American Agricultural Chemical Co., New York, is building the plant on a 64-acre site. The first phase of construction is scheduled for completion next fall.

•

Stauffer Sales Supervisor

The Stauffer Chemical Co., New York, has named Larry E. Prince to the position of agricultural chemicals sales supervisor for North and South Carolina, Alabama, Georgia, Tennessee, and northern Florida. He joined Stauffer in 1951.

•

Form Fisons (Canada) Ltd.

Fisons Ltd., an English firm, has formed a new Canadian company, Fisons (Canada) Ltd. The agricultural chemicals division of the new company will market Simazine and Diazinon for the control of weeds and insects in British Columbia, Quebec, and Ontario.

•

NFSA To Meet Nov. 8 to 10

The National Fertilizer Solutions Association has announced plans to hold its 1959 convention at the Statler Hilton Hotel in St. Louis, Mo., Nov. 8 to 10.

•

Frontier Research Building

Frontier Chemical Co., Division of Vulcan Materials Co., Wichita, Kans., is planning to build a research and development building near the company's manufacturing plant eight miles southwest of Wichita.

The facilities will provide working space for 20 research chemists and chemical engineers.

•

Distributor For M & C

Van Horn, Metz & Co., New Kensington, Pa., has been appointed as distributor for the complete line of inert minerals produced by the Minerals & Chemicals Corp. of America. The new distributor will serve customers in western Pennsylvania and northern West Virginia.

•

Friends Honor Carter

Arthur H. Carter, recently retired general manager of Green Cross Products, Montreal, was honored by a gathering of his friends at the Engineers' Club in Montreal. George E. Flemming, president of the Canadian Manufacturers of Chemical Specialties Assn., was chairman of the gathering. Among those present were M. F. Anderson, executive vice president of the Dominion Rubber Co.; and Jack Elliott, Rohm & Haas.

To Buiid 2nd Korea Plant

Another urea plant, with the capacity to satisfy one-third of Korea's current fertilizer requirements, will be erected with German technology at Najoo in the southwestern part of the Korean peninsula. It is being constructed exclusively with Korea's own capital resources. The equipment and machinery will be purchased from West Germany.

•

Drops Grasselli Name

E. I. du Pont de Nemours & Co., Wilmington, Del., has formed a new corporate wing, the Industrial and Biochemicals Dept., which will take over all Grasselli Chemicals operations.

Former Grasselli units coming under the new department include all 11 plants in Ohio, Pennsylvania, Michigan, Indiana, New Jersey, Virginia, Kentucky, and Texas.

•

Dixon Offers Pesticides

The I. P. Thomas Division of Dixon Chemical Industries, Inc., Paulsboro, N.J., is marketing under its "Dixco" label a complete line of pesticides. The company now offers a one-stop shopping center for agricultural chemicals in which a farmer can pick up both his fertilizer and pesticide needs in one trip to the Paulsboro plant.

•

Naugatuck Names Cruickshank

James A. Cruickshank has been appointed general sales manager of Naugatuck Chemicals, Division of Dominion Rubber Co., Ltd. He joined Naugatuck in 1946 and was named assistant general manager in 1955. Mr. Cruickshank's headquarters are at the Naugatuck offices in Elmira, Ontario.

•

Texaco Names Fischer

Charles B. Fischer has been named Texaco's petrochemical sales representative for ammonia and nitrogen solutions in Indiana, Michigan, Ohio, and Kentucky. His headquarters are in Chicago.

List CACA Meeting Topics

The Canadian Agricultural Chemicals Association has published a list of the topics to be discussed at its 1959 convention, Sept. 20 to 23, at the Chateau Frontenac, Quebec.

Among the topics listed are: a panel on agricultural extension as it affects industry and the farmer, headed by Dr. Harold Baker, University of Saskatchewan; and a panel on maleic hydrazide to consist of representatives from the industry, government, and two farmers. Also, aerial spraying of farmlands, to be discussed by Dr. F. E. Webb, Forest Biology Laboratory, Canadian Department of Agriculture; and the market in Quebec for pesticides, for which topic the platform will be shared by Charles Gagne and Andre Descheigny.

•

New Geigy Herbicide

Geigy Agricultural Chemicals, Division of Geigy Chemical Corp., Ardsley, N.Y., has introduced a triazine herbicide, Prometone 25E, for non-selective or industrial weed control in non-cropped areas.

A post-emergence herbicide, Prometone 25E (known also as Methoxy Propazine and G-31435) is said to control most annual and many perennial weeds and grasses. It appears especially promising for control of Johnson grass and Bermuda grass, the company said.

•

OK Toxaphene On Pastures

A label clearance by the U.S. Department of Agriculture allows the application of Toxaphene for grasshopper control to land being grazed by meat animals, and also permits animals to be treated with Toxaphene formulations for control of ticks, lice, flies, and other destructive pests.

•

Spencer Shifts Four

The Spencer Chemical Co., Kansas City, Mo., has announced the reassignment of four agricultural chemicals division personnel. Byron M. Kern, general manager of production, was appointed general sales manager; and Harold E. Bingham, general sales manager, has been put in charge of the development of new products.

Harold Ihde, director of marketing, has been named to assist Mr. Bingham. Jack E. Straub, assistant to the vice president, will handle the duties of the general manager of production. The company said that the reassignments are for the purpose of cross-training.

S.W. ESA Branch Sets Date

The 1960 meeting of the Southwest Branch, Entomological Society of America, will be held at the Hilton Hotel, El Paso, Texas, on February 8 and 9.

•

Donovan Joins Borax

D. R. Donovan has joined the agricultural sales department of the Pacific Coast Borax Co. division of the United States Borax and Chemical Corp., Los Angeles. His headquarters are in Pittsburgh, Pa.

Potato Virus Picture

The first 3-D picture of a tiny virus that infects 10 to 30 per cent of the nation's potato crop was described at the American Chemical Society's Northwest Regional Meeting, June 19, in Seattle, Wash.

Dr. M. E. Reichmann, research officer, Canada Agricultural Research Station, University of British Columbia, said that the measurement of the rod-like parasite's external features is a part of a long-range project to relate the structure of plant pests with their harmful effects.

The speck-like virus, known as potato virus X, is less than two hundred-thousandths of an inch long and its width is only a fiftieth of its length, Dr. Reichmann said. Previous research had indicated the virus to be much longer.

•

Rhodesia To Use Lake Mud

Tests being conducted at the Central Agricultural Research Station in Chilanga, Northern Rhodesia, indicates that mud from the bottom of Lake Bangweulu may solve Central Africa's crucial problem of soil fertility.

The mud is said to contain ten to fifty times the amount of ammoniated nitrogen available in ordinary Rhodesian earth.

•

Cyanamid Plant Manager

E. F. Grieb has been appointed manager of the American Cyanamid Co.'s Fortier plant in New Orleans, La., He succeeds C. F. Bonnet, who has been named associate regional director-Europe of Cyanamid International. Mr. Grieb joined Cyanamid in 1935.

•

Named To New Dow Office

John M. Hill has been named by the Dow Chemical Co., Midland, Mich., to be a resident salesman in Scottsdale, Arizona. He formerly was assigned to the Los Angeles area. Mr. Hill's new territory will cover Arizona and the Imperial Valley of California.

He is replaced at Los Angeles by H. Allen Sisson.

Discontinue Division Names

The Smith-Douglass Co., Norfolk, Va., has announced that individual names for its operating divisions will be discontinued, effective August 1. The Smith-Douglass corporate name will be used for the entire company, including the San Jacinto Chemical Co. division.

•

Distributor For Dorr-Oliver

Dorr-Oliver Inc., Stamford, Conn., has appointed Equipment Engineers, Inc., Philadelphia, as sales and service representative for Dorr-Oliver process pumps in Delaware and Maryland. The distributor already represents Dorr-Oliver in eastern Pennsylvania and southern New Jersey.

•

Midwest Sales Supervisor

Allan F. Dow has been appointed petrochemical sales supervisor for the Midwest by Texaco Inc., New York. His headquarters are in the McCormick Building, Chicago.

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U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
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New Sulfur Extraction Plant In Operation In Canada

A sulfur extraction plant, capable of producing 100,000 tons of elemental sulfur annually from "sour" gas, was put in production last month at Okotoks, Alberta, Canada. The installation is being operated by the Texas Gulf Sulphur Co., New York, who are joint owners of the plant, along with Devon-Palmer Oils, Ltd. and the Shell Oil Co., Canada, Ltd.

Named To New Sales Post

Howard C. Peterson Jr. has been appointed to the new sales post of Corporate Account Executive by the St. Regis Paper Co., New York. He joined St. Regis in 1952 and has been associated with the company's Kraft Division.

•

Calspray Plant Engineer

Donald J. McCormick has been appointed plant engineer at the California Spray-Chemical Corp.'s fertilizer plant, now under construction at Kennewick, Wash.

•

OK Malathion On Rice

The use of Malathion for the control of rice stinkbug has been accepted by the U.S. Department of Agriculture.

The insecticide, manufactured by the American Cyanamid Co., New York, now can be applied for the control of stinkbug during the early milk and dough stages of growing rice. Applications can be made within seven days of harvest.

•

Weed Conference Sets Date

The fourteenth annual meeting of the Northeastern Weed Control Conference will be held Jan. 6, 7, and 8, 1960, at the Hotel New Yorker, New York.

•

Head 4-H Fund Drive

R. E. Bennett, president of Farm Fertilizers, Inc., Omaha, Nebr., and Dean R. Gidney, vice president of the United States Potash Co., New York, are co-chairman of a special fund raising program which got underway last month on behalf of the National 4-H Club Foundation.

•

Agronomic Services Manager

Dr. Donald P. Satchell has been named manager of agronomic services for the American Agricultural Chemical Co., New York. He succeeds O. C. Leetun, who has retired after 40 years with the company.

Before joining Agrico earlier this year, Dr. Satchell had been on the agronomic research staff of Pennsylvania State University for seven years.

•

Stauffer Vegetable Dip

A dip to prevent the development of various rots and molds on fruits and vegetables now is being marketed by the Stauffer Chemical Co., New York. Called Captan 80 Spray-Dip, the product is a microfine wettable powder containing 80 per cent Captan. It is applied as a spray or in wash tanks during normal packinghouse operations.

•

Register Dylox For Alfalfa

Dylox 50 per cent soluble powder, a product of the Chemagro Corp., Kansas City, Mo., has been registered by the U.S. Department of Agriculture for use nationally on alfalfa, cabbage, and sugar beets for the control of a variety of injurious insects.

NPFI NEWS

Conducting Fertilizer Study

A study to determine who makes the decisions about using fertilizer on California farms now is underway at the University of California's Davis campus. The study is being sponsored by a grant of $2,500 from the NPFI.

Two university research workers, Luverne Donker and Douglas Kleist, are conducting the study under the direction of Dr. Orville Thompson of the university's department of education. Dr. Richard B. Bahme, Western Regional Director of the NPFI, said that the results of this study would have significant implications to the fertilizer industry, as well as to university extension workers and to farmers.

NPFI On Farm And Home Hour

Representatives of the National Plant Food Institute appeared on the National Farm and Home Hour radio show recently to present a Plant Food Round Up.

Among those heard on the nationwide program were: Louis H. Wilson, director of information; Dr. Russell Coleman, executive vice president; Dr. Samuel Tisdale, Southern regional director; Dr. Richard Bahme, Western regional director; and Zenas Beers, midwestern regional director. The officials pointed out the advantages to farmers of the use of more Fertilizer.

Colorado Fertilizer Booklet

A 20-page brochure, entitled "Putting Profits into Colorado Farming and Ranching," has been published by the Colorado Bankers Assn., in cooperation with Colorado State University. The booklet was prepared and printed for the bankers association by the NPFI.

The booklet is designed to "show how and why the wise use of commercial fertilizer in conjunction with other practices recommended by Colorado State University can increase farm profits."

Discuss Forest Fertilization

The NPFI's Forest Fertilization Task Force met March 24 and 25 at the Dinkler-Plaza Hotel in Atlanta, Ga., to discuss fertilization research in southern forestry. The project is under the general direction of Dr. L. C. Walker, chief forester of the Institute, and the group is composed of industrial scientists and research foresters.

Among the items considered at the Atlanta meeting were the establishment of a clearing house for experiments underway and the establishment of a service laboratory to handle analyses of soils and plant tissues.

Wisconsin Achievement Award

Donoval L. Waugh, a senior student in agronomy and soils at the University of Wisconsin, was 1958-59 winner of the National Plant Food Institute's Agronomy Achievement Award for that University.

Equipment, Supplies, Bulletins

Applicator For Orchards

General Metals, Inc., Greensboro, N. C., is offering an applicator designed especially for applying nitrogen solutions and complete liquid fertilizers to orchards.

Applicator Model 450 consists of a rugged trailer frame, special boom, heavy-duty tank saddles, 235 gallon tank, Dempster metering pump, front end jack, and a special shield to prevent limbs from getting caught in the applicator.

•

New Surge Bin

The Rapid Machinery Co., Marion, Iowa, is offering the Marion Surge Bin, designed for continuous mixing operation. Used in conjunction with a Marion horizontal mixer, it is said to provide greater mixing capacity.

•

New Sturtevant Micronizer

The Sturtevant Mill Co., Dorchester, Mass., has developed a tungsten carbide lined Micronizer fluid energy mill for the fine grinding of severely abrasive materials up to the hardness of tungsten carbide.

The micronizer, which has no moving parts, effects ultra-fine pulverization through super speed rotation of particles produced by opposing tangential jets of compressed air or steam.

Mineral Fillers Bulletin

A four-page service bulletin that offers complete technical data and properties of the Aquafil Co.'s diatomaceous earth products is being offered by the company.

The bulletin, which is available from the company at 321 State St., Los Altos, Calif., describes the uses of Aquafil diatomite in the insecticide and fertilizer fields.

•

Deciduous Fruit Spray Chart

A chart that outlines recommended procedures for the control of a number of deciduous fruit tree insect and mite pests has been published by the Stauffer Chemical Co., New York.

Major emphasis is placed on dosage recommendations for Trithion. Crops include apples, crab apples, pears, cherries, plums, peaches, and grapes.

•

Garden Clinic Guide

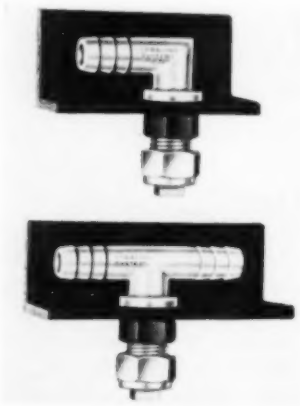
E. I. du Pont de Nemours & Co., Wilmington, Del., is offering the 1959 edition of its "Garden Clinic Guide" through dealers handling Du Pont garden chemicals.

•

Angle-Iron Boom Nozzles

A new type of TeeJet nozzle has been introduced by Spraying Systems Co., Bellwood, Ill., that permits the fabrication of a spray boom from an angle-iron instead of piping.

The nozzles are supplied with double and single hose shank bodies for inside and end positioning on a boom. Complete information on the new nozzles is available from the company at 3230 Randolph Street, Bellwood.



Wayne Hand Pump

The Wayne Pump Co., Fort Wayne, Ind., has designed a lightweight hand pump to handle liquid fertilizers and other salt solutions as well as tractor fuels, gasoline, and lubricating oils.

A stainless steel shaft operates in a heavy duty nylon bearing to provide delivery of about 20 gallons per 110 strokes.

•

FP Specification Sheet

Specification Sheet 70M2011, offered by the Fischer & Porter Co., Hatboro, Pa., describes a new Micro-H chemical feeder which accurately meters, regulates, and feeds liquid chemicals continuously at extremely low flow rates from 0/1 to 4.0 gallons a day.

•

Co-Ral Livestock Duster

The Chemagro Corp., Kansas City, Mo., is offering its Co-Ral livestock insecticide in a five-ounce squeeze bottle for spot treatment of screw worms or ear ticks. The product previously has been offered only in spray form.

•

Crabgrass Preventative

A crabgrass preventative for use on established turf is being offered by the Chipman Chemical Co., Bound Brook, N. J. Called Chip-Cal Granular, the product is ready for use and can be applied by a mechanical fertilizer spreader or a portable seed-sower.

•

Chemicals In Foods

The Association of Food and Drug Officials of the United States, Austin, Texas, has published a book, "Appraisal of the Safety of Chemicals in Foods, Drugs, and Cosmetics," by Dr. Arnold J. Lehman of the U. S. Food and Drug Administration. The book is available from the Austin office at $2 per copy.

•

World Fertilizer Review

"An Annual Review of World Production and Consumption of Fertilizers—1958" has been published by the Food and Agriculture Organization of the United Nations. Copies of the review may be obtained from the International Document Service, Columbia University Press, 2960 Broadway, New York 27. The price is $1.

•

Aids For Fertilizer Mixer

In the past two years fertilizer suppliers have made very important contributions to assist fertilizer mixers in the production and sale of fertilizers. The Nitrogen Division, Allied Chemical Corp., two years ago expanded its technical service to mixers with a monthly 4-page insert directed to the manufacturer on how to make fertilizers, and how to increase sales. These inserts still are carried monthly in leading trade magazines.

Texaco Inc. recently issued a new 40-page manual on ammonia and nitrogen solutions, carrying information on mixed fertilizer manufacturing processes, safety in handling ammonia and nitrogen solutions, selection of nitrogen solutions, and discussions on other aids in handling and using nitrogen solutions.

Most recently, Spencer Chemical Co. published the "Spensol Greeen Handbook", a 126-page book for use by mixed fertilizer manufacturers. It covers both granular and nongranular methods of manufacture, including formulas for production of all commercial analyses. It also contains basic tables useful in production calculations, plus illustrations of recent innovations in mixed fertilizer manufacturing. The book is a third revision of a handbook which has been a standby for many mixers since Spencer went into the ammonia business.

Not too long ago, Sohio Chemical Co. prepared two handbooks for the manufacturer of liquid fertilizers, and introduced these at a symposium held for liquid fertilizer manufacturers. Technical booklets and literature also are offered by Commercial Solvents Corp., Grace Chemical Co., U. S. Industrial Chemical Co., Grand River Chemical Div. of Deere & Co., and Phillips Chemical Co.

Oscillating Car Underloader

The Link-Belt Co., Chicago, has announced a 50 per cent increase in the unloading rate of its Kar-Flo oscillating car unloader. The use of air springs makes it possible to unload six cars per hour rather than four as previously. The equipment was originally designed to facilitate unloading of grain cars, but can be adapted to cars carrying other free-flowing materials.

The Kar-Flo is an oscillating platform upon which two rails, one eight inches higher than the other, are mounted. A loaded car is spotted upon the platform and automatically centered and locked in place by two hydraulically operated car clamps. The car door then is opened, the unit is put in motion at a control panel, and the car is oscillated to empty its contents.

The company is offering a booklet, Book 2845, that describes the operation.

•

Terraclor Guide

A new Terraclor application guide for beans giving detailed information on the effective use of this soil fungicide is now being widely distributed in the northeastern, southeastern and far western bean-growing areas by the Olin Mathieson Chemical Corporation.

Object of the illustrated four-page guide is control of Root and Stem Rot and White Mold. The company also is offering an application guide for peanuts to growers in the South.

Additional information can be obtained by writing to Olin Mathieson Chemical Corporation, Insecticide Products Department, Baltimore 3, Md.

•

Urox Weed Killer Folder

The General Chemical Division of the Allied Chemical Corp., New York, is offering a folder on Urox weed killer. The folder contains photos showing some of the weed control results that can be expected from use of the product, a granular herbicide.

Sturtevant Pulver-Mill

A vertical hammer mill, with an integral air classifier for the extremely fine grinding of soft, non-metallic materials in capacities up to 5,000 pounds an hour, has been introduced by the Sturtevant Mill Co., Dorchester, Mass.

Called the Sturtevant Pulver-Mill, the unit features a unique deflector wall construction. As the rigid revolving hammers crush the material between stationary wall hammers, the special deflector wall "bounces" insufficiently ground material back into the grinding zone.

•

Sak-Pak Expendable Pallets

Calco Supply Co., San Francisco, reports that its lightweight "Sak-Pak" expendable pallets, originally introduced into the cement industry, now are being used for loading chemicals, lime, fertilizer, and other bagged products.

The pallets are made of corrugated paper reinforced with Kraft Veneer board. Each can carry approximately 4,000 pounds and the pallets can be stacked three high. They weigh five pounds each.

•

Insect-Repellent Report

The Insect-repellent properties of 534 experimental chemical compounds are described in a report issued by the U.S. Department of Agriculture.

Most of the compounds were synthesized by the USDA's Agricultural Research Service and all were tested by the Agricultural Marketing Service for possible use in developing insect-resistant packages. The booklet, Market Research Report No. 324, is available from the Office of Information, USDA, Washington 25, D.C.

•

Jet Pulverizer Brochure

The Jet Pulverizer Co., Palmyra, N. J., is offering a brochure on the grinding, pulverizing, and processing actions of jet pulverizers. The company produces pulverizers in eight custom-made sizes, with mill diameters from 2 to 36 inches.

BREVITIES

A TWO-ALARM FIRE of undetermined origin last month destroyed Acme Byproducts Co.'s plant in Salt Lake City, Utah. The firm deals in fertilizers and building materials.

AC

THE INDONESIAN government has contracted with the Foster Wheeler Corp., New York, for the construction of a prilled urea plant near Palembang, Sumatra.

AC

B. E. THORNE has been named sales manager for New England by the American Agricultural Chemicals Co., New York. His headquarters are in North Weymouth, Mass.

AC

FREDERICK KOECHLEIN, general manager of the Phosphate Division of the International Minerals & Chemical Corp., Skokie, Ill., recently passed the 30th anniversary of his employment with the company.

AC

C. C. HAMMER has been elected treasurer of the Bemis Bro. Bag Co., St. Louis, Mo. He succeeds T. W. Little, who retired.

AC

R. H., AND N. R. HERNDON AND C. M. FURRER have incorporated Normair, Inc., 801 Depew Street, Denver, Colo., to engage in the business of application of insecticides, fungicides, herbicides or other agricultural chemicals.

AC

THE COOPERATIVE OIL CO., Goodland, Kansas, has been authorized by its members to investigate the possibilities of purchasing a plant for the manufacture of nitrogen solutions.

AC

FRED POWELL has been named president of the California Chemical Co., a subsidiary of the Standard Oil Company of California. He will coordinate the activities of Standard's two chemical subsidiaries, California Spray-Chemical Corp. and the Oronite Chemical Co.

NPFI MEETING

(*From Page* 32)

beginning of the season, calculations should give a fairly refined estimate of the odds in favor of profits from various levels of fertilizer use. The farmer's own situation and inclinations would then determine which odds he would choose. Of course, the collection and correlation of the needed data will take time."

"The farmer's odds in favor of profits from fertilizer use," Dr. Hildreth concluded, "appear to be greater than many think," adding that "fertilizing in the future will be done on the basis of much more precise calculations than are possible today."

Production Controls Needed

IN discussing the farm program, and the continuing problem that farmers of the Nation face in getting their fair share of the national income, Rep. Jamie L. Whitten (D. Miss.) called for controls on production rather than on acreage as being more realistic. The point was not lost on an audience that is thoroughly familiar with the fact that modern chemical tools such as fertilizers and pesticides can make acreage restrictions meaningless. The speaker also demanded a farm program which will make it possible for the farmer to get his fair share of the national income in the market place. Farmers, he emphasized, prefer to get their income in a free market, without governmental interference and without subsidy from the Federal treasury.

He recognized, however, that so long as labor and industry are favored by protective laws, "We must have price protection for farmers – particularly on storable commodities, where production one year is in the way of the following year's crop." Without such protection, U. S. commodity prices, he asserted, would quickly drop to world levels, and another great depression would be underway.

Rep. Whitten recommended the following proposals as cornerstones of a revised and more workable farm policy:

1. Provide price protection on the farmer's share of the domestic market tied to the costs of the items he must buy.
2. Require the farmer to limit production (rather than acreage) and make price protection given him on storable commodities contingent on his holding his production in line with domestic and foreign markets.
3. Require the government to sell excess production competitively in world markets.
4. Require that the government announce price stabilization programs as soon as the likelihood of a surplus becomes apparent, and not delay such programs until after markets have broken and are demoralized.

At the conclusion of the meeting, the NPFI Board of Directors elected J. D. Stewart, Jr., of Louisville, Ky., as president, and Richard E. Bennett, of Omaha, Neb., as chairman of the Board. Mr. Stewart is president of the Federal Chemical Co., Louisville, Ky., and Mr. Bennett is president of Farm Fertilizers, Inc., of Omaha, Neb.

Other officers, all of Washington, D. C., were re-elected as follows: Executive vice presidents, Paul T. Truitt and Russell Coleman; vice president, W. Raoul Allstetter; secretary, Louis H. Wilson; treasurer, William S. Ritnour.

Members of the Executive Committee elected are as follows: Ralph B. Douglass, Smith-Douglass Co., Norfolk; John W. Hall, Potash Company of America, Washington, D. C.; Stanley S. Learned, Phillips Petroleum Co., Bartlesville, Okla.; Justin Potter, Virginia-Carolina Chemical Corp., Richmond; C. T. Prindeville, Swift & Co., Chicago; W. E. Shelburne, Armour Agricultural Chemical Co., Atlanta; Jacob White, Nitrogen Division, Allied Chemical Corp., New York, N. Y.; and Mr. Bennett and Mr. Stewart.

L. M. Roberts, Shell Chemical Corp., San Francisco, was elected to the Board of Directors to fill the unexpired term of G. R. Monkhouse, whose term expires June 1961.

JOHN NAHIKIAN has joined the Fertilizer Section of the National Safety Council as a staff representative.

MARKET REPORT

(*From Page* 10)

– which in turn have brought about lower prices for ammonium sulfate.

On the domestic scene, a recent spurt in buying has steadied nitrogen prices – temporarily at least. With the indicated annual rate of nitrogen consumption still only about 75 per cent of productive capacity, some producers contend that about the best that can be expected in the near future is a firming up in the price situation, at around present listed price levels.

One reason for the recent spurt in sales of nitrogen compounds has been belated last-minute buying by farmers who had held back purchasing commitments this year in hope that prices might ease off further. The present rush of buying is expected to continue through this month due to a late season caused by rains in some areas, also due to anticipated demand for side dressing in July.

Allied Chemical has announced that it will continue the present price of its nitrogen fertilizer solutions through the third quarter of this year. The current price for representative nitrogen solutions per ton of nitrogen is $120. For the fourth quarter of this year, they will advance, as is usual for the season, to $124 per ton.

EDITORIAL

(*From Page* 23)

areas, it would do much to promote fertilizer sales, both directly and indirectly.

A similar excellent job for the pesticide industry has been done by at least one basic supplier recently, with publication of a short course on insecticides for dealer sales personnel. The idea has so much to recommend it that it would certainly seem to us to make sense for some group to adopt the idea as an industry-wide project another year. There is a big potential for increased pesticide sales, as there is for a bigger fertilizer market, but the markets will not grow by themselves.★★

NATIONAL STEARMAN

(*From Page* 57)

the empty stall speed of the Stearman has been reduced from 59 mph to 35 mph.

Because of their increased span, the Hi-Lift wings had the effect of moving the lower wing ailerons inboard to a less efficient position. To improve lateral control, NAC added ailerons to the upper wings. The addition of wing splates (tip discs) to the upper and lower wings further served to improve low speed aileron control and added to the total lift. By controlling wing tip vortices, the splates also tend to provide for better swaths.

Other features of the NA-75 are chrome-moly wire cutters installed on landing gear legs, wing struts, and the vertical fin, and the location of the instrument panel in the center section of the top wings, thus keeping all gauges in the pilot's line of vision during flights.

Approved engines for the NA-75 are: Continental 220 and 250 H.P.; Lycoming 225 and 300 H.P.; Jacobs 225, 275, 300, and 330 H.P.; Wright 450 H.P.; and Pratt & Whitney 450 H.P. Operators using the Wright and Pratt & Whitney engines with the NA-75 are reported to be hauling loads in excess of 2,000 pounds safely and consistently. The empty weight of the NA-75 Stearman with a 220 H.P. engine will be around 2,100 pounds. It will carry a load of 1,300 pounds. Empty weight of the 450 H.P. NA-75 Stearman runs around 2,400 pounds, gross weight about 4,225 pounds.

The price of the NA-75 "composite" Stearman is $13,500, minus the engine and propeller.★

Table 1. Use of fertilizer on crops and pasture, 1954[1]

Crop	Acreage fertilized	Percentage of harvested acreage fertilized	Plant Nutrients Used Total	Rate per acre fertilized
	1,000 acres	*Percent*	*1,000 tons*	*Pound*
Corn	46,873	60	1,888	80
Cotton	10,948	58	572	105
Tobacco	1,515	97	226	298
Sugar Beets	776	92	49	127
Sugarcane	299	96	14	92
Soybeans	3,075	18	102	69
Drybeans	838	54	23	58
Peanuts	1,001	62	54	86
Potatoes and sweetpotatoes	1,114	78	171	299
Vegetables	3,642	63	381	209
Fruits	2,422	58	182	151
Grain Sorghums	2,719	27	54	40
Intertilled crops	75,252	51	3,705	98
Wheat	14,034	28	452	64
Oats	11,559	31	402	71
Barley	3,222	27	82	52
Rye	322	25	12	76
Rice	2,055	84	59	64
Close-growing crops	31,192	28	1,007	65
Hay and pasture[2]	18,235	11	748	82
All crops and pasture	124,679	30	5,460	88

[1] Based on census data supplemented by estimates made by State committees. Crops included account for about 98.5 percent of all fertilizer used on the farms in 1954.
[2] Includes hay and rotation pasture in all regions and permanent pasture in the humid regions.

FERTILIZER ECONOMICS

(*From Page* 40)

Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C.

An earlier study on the same general subject resulted in publication of another ARS booklet (ARS 43-63) under the title "Substituting Fertilizer for Land in Growing Corn." D. B. Ibach, the author, pointed out that although the use of fertilizer on corn has grown markedly in recent years, "considerably higher rates of application would be profitable on most farms in the principal corn-producing areas." On the average, he concluded, studies of response of the corn crop to fertilizer indicate that rates as high as 300 lbs. of fertilizer per acre would be logical. This compares with the '54 average use of approximately 80 lbs. per acre on the fertilized acreage.

Projecting his study to the corn crop needed for the year 1975, Mr. Ibach concluded that "if fertilizer were applied on the same acreage that was fertilized in 1954 at rates that would result in a marginal return of $2.50," 1975 corn needs could be produced on fewer acres than where harvested during the years 1943 and 1944.★★

PESTICIDE COURSE

(*From Page* 37)

try them on a few acres and compare yields and quality at harvest time. Besides a small immediate profit, the salesman can expect a larger profit in subsequent years. A word of caution, however, is offered to dealers to make sure that test plots are handled the same as untreated plots as to tillage, fertilizer, and cultivation. Also the dealer should supervise application of the insecticide.

On-the-farm selling trips should be timed so that the salesman gets to the farm before damage is severe, but after some indication of the need for insect control has appeared. The salesman should carry plenty of pesticides, literature, and proof of results with him on such trips and it will help him to have a good background in insect control and identification.

Getting acquainted with custom applicators, who, in some areas, apply most of the insecticides used, usually is profitable for dealers. Sudden outbreaks, insect migrations, equipment failures, changes in recommendations, or other circumstances may leave farmers with no way to apply the insecticides they need. Custom applicators may save the dealer's sale and his customer's crop.

In handling complaints that an insecticide did not do the job, the salesman is advised to find out from the customer whether he followed the directions on the label and how and when the chemical was applied. The dealer can then treat a section of the area himself and return at a later date to check results. If it is too late to try a second treatment, a free test treatment can be offered for the following season.

In conclusion, the Velsicol course recommends that a complete merchandising program should include: adequate stocks, a complete-line advertising display, knowledge of the products, proper timing, and a positive sales approach.★★

PEST ROUNDUP

(*From Page* 62)

Arkansas. This is a rather heavy brood and in many areas noticeable damage was caused by oviposition in various trees; fruit, ornamental and forest.

During May, a pine saw fly was severe on pines in widely scattered areas of Virginia and in areas of North Carolina, Maryland and Pennsylvania. Tent caterpillars were unusually heavy and damaging in many areas during May. States reporting heavy populations include Rhode Island, Pennsylvania, Ohio, Virginia, West Virginia, Utah, Nevada and California.

The greenbug, which was reported last month as being damaging in Oklahoma and Texas, continued to cause damage in several states during May. Although by late May populations were on the decrease in Missouri, late planted oats in the northeast and north central areas were severely damaged. Counts up to 5,000 per linear foot were recorded. Oats from south central to north central Illinois and small grains in southern Iowa were being seriously damaged. Greenbugs were also present in most southern Minnesota grain fields, only but one field in Nicollet County was reported as being seriously damaged.

The pea aphid decreased in some of the southern areas reported having heavy populations last month, but increases were noted in states farther north. States with abundant populations in late May include Maryland, Kansas, Iowa, New Mexico, Colorado, Utah and Idaho.★★

APPLYING DOPE

(*From Page* 56)

mets is with the second coat of dope. This can be done by doping up to a rib or section where tape is to be applied, laying the tape on the doped surface, rubbing it down, and proceeding with the application of the dope up to and over the next area to be taped.

Generally, each coat should be allowed to dry to the touch before another is put on. No longer than 24 hours, however, should elapse between coats or the undercoats will have to be rejuvenated before continuing.

Following the application of the clear dope, aluminum coats

are used for easier sanding and to provide protection from the sun for the undercoats. It is generally recommended that dope already containing the aluminum mixture be used because of the difficulty of adding just the right amount of aluminum to clear dope. A minimum of two coats usually are sprayed on and the aluminum is sanded after each coat. The last coat of aluminum should be allowed to dry overnight before being sanded to a smooth surface with No. 280 Wet or Dry paper.

For best results, color coats are sprayed on. When the color coats must be brushed on, because spray equipment is not available, the dope must be thinned with 25 to 50 per cent of thinner retarder. For such colors as yellow, about four coats should be applied, because dopes are not pigmented as highly as other paints. The last color coat generally contains one part of color to one part of clear to one part of retarder. This assures a high gloss.

The biggest cause of fabric and finish failure is the improper application of the first coat of dope. Too few finishers realize that fabric is the base of the finish and gives the bulk of the strength to the airplane's skin.

The choice of dope for finishing is a matter of preference. In comparing butyrate dopes with nitrate dopes, it has been found that butyrate is less likely to burn in the event of a crash. In addition, butyrate dopes are internally plasticized and retain their plasticity much longer than nitrate dopes, to which plasticizers must be added. Nitrate dopes, on the other hand, are somewhat less expensive than the butyrate dopes.★

LISTENING POST

(*From Page* 63)

replicate heavy infestation persisted during 4 years of continuous potato growing. Not one specimen of the nematode was recovered from samples taken 10 inches deep in heavily infested soil.

The 1954 data indicated that EDB gave best results, but they also showed that when the nematocide was applied in spring, yields were considerably reduced. To determine whether later application might provide effective control and at the same time be less toxic, split plow sole applications were made in two heavily infested 3-acre fields, in early June and in late August. A heavily infested 24-acre field and a lightly infested 4-acre field were also given fall treatment. EDB was applied in the fall of 1955 and planting was done in the spring of 1956. No infected tubers were found, either at harvest or after storage for 4 to 6 months.

In 1957 the 24-acre and 4-acre fields and one small experimental plot were replanted to potatoes, without additional treatment. Again, not a single infected tuber was found in the crop from the treated areas. An interesting observation was the sharp contrast

between a heavily infested check plot and the contiguous fall-treated plot: infection dropped from 100 percent in the untreated check to 0 in the treated plot at the exact point in the row where the treatment began. The contrast was evident again when the area was replanted the second season after treatment.

An experiment was planned to determine whether lower degrees of EDB would be effective. In the fall of 1955 split plow sole applications were made at the rates of 4, 5, and 6 gallons per acre, and potatoes were planted in the spring of 1956. At harvest in 1956, 23, 5, and 0 infected tubers, respectively, were found in the treated plots. The fact that very few infected tubers occurred in the untreated check indicated that infestation in the experimental location was not uniform.

The Dow Chemical Company analyzed tubers from both untreated and EDB-treated plots for bromide residue. Data for the 1956 crop from the 1955 fall-treatment showed bromide residues ranging from 5.6 to 53 parts per million (ppm), average 19.1 ppm, for treated plots, and 1.6 to 15 ppm, average 5.6 ppm, for untreated checks. Residues in samples from the 24-acre field averaged 13.7 ppm in 1956 and 8 ppm in 1957 in the treated area and 5 ppm in 1956 and 1 ppm in 1957 in the untreated check. For restricted use in Wisconsin and Idaho the Federal Pesticide Regulatory Agencies allow a 75-ppm tolerance of inorganic bromide residues resulting from soil treatment with EDB.

Conclusion:

Dr. Darling comments on some aspects of the potato rot nematode control problem. For complete kill lethal amounts of the nematocide must penetrate the soil thoroughly. Temperature affects volatility and determines date of application. At 50°F, the minimum temperature for EDB application, volatility is low. Soil temperatures

higher than 50° at application depth usually do not occur until late May or early June in Wisconsin. When treatment is started in early June, potatoes must be planted very late and the usual result is an unprofitable crop; the plants show effects of toxicity and yields are depressed. Few crops can be grown during the summer following a spring treatment. On the other hand, in early September soil temperatures are consistently within a good range for fumigation. Moreover, a spring cash crop for harvesting prior to treatment can be grown if the soil is treated in the fall.

The very high level of control obtained with EDB under conditions of very heavy infestation raises the question of the possibility of complete eradication of the nematode. Perhaps fumigation by itself would not be sufficient because of the chance of recontamination. However, the combination of effective fumigation and the rigorous quarantine regulations imposed in Wisconsin reduces the possibility of reinfestation to a minimum. Continuous annual surveys have demonstrated the effectiveness of the quarantine program in restricting the spread of the nematode. The cost of treatment is about $40 an acre. So far, 250 acres on which the program can be evaluated further have been treated.★★

GRANULATING PLANT

(*From Page* 45)

ing ammonia in solutions, the two materials in stoichiometric amounts should be brought together downstream from the flow meters in a preneutralizer tank.

Bringing the acid and solutions together in this fashion permits higher temperatures without suffering nitrogen losses. The evaporation of this water results in a lowering of the liquid phase and an over-all dilution of temperature.

The ammonium nitrate, sulfate of ammonia slurry flows by gravity into the ammoniator. Solid raw materials and recycle join the liquids in the ammoniator or pug mill, where proper conditions for granulation are maintained. The ammoniator or pug mill must be sized to handle not only the input of raw materials but also the recycle.

From the ammoniator or pug mill the material flows by gravity to the dryer. In most plants, the dryer is under-designed. The mechanical condition of the finished product is dependent on the moisture content more than any other one thing.

Many plants, in an effort to get the moisture content low enough to insure good mechanical condition, increase the dryer temperature to the point where heat sensitive material decomposes, resulting in plant food loss and air pollution. Some dryers are even designed so that the burner flame actually comes in contact with the material. This should never be done.

The material from the dryer should be elevated and classified. The fines should flow into a recycle hopper to be fed back into the system as needed. The oversize should flow to a crusher and back into the dryer. Oversized particles are wet on the inside and should not be returned to the screen until the crushed material has passed through the dryer a second time. The onsize should flow to the cooler.

The screen should also be of sufficient capacity to handle recycle, as well as finished product. Poor screening frequently is responsible for fines getting into the finished product. Also, it can cause the system to get off balance.

The cooler should be of sufficient capacity to send the finished product to storage below 120°F.

Grades containing more than 300 pounds of ammonium nitrate should be coated with diatomaceous earth to prevent caking.

Summary

Steam is the most economical source of auxiliary heat and liquid phase when sufficient volume of grades are produced.

Recycle is the most economical means of controlling excess heat and liquid phase.

A preneutralizer also helps control over-all heat and liquid

phase, as well as reducing nitrogen losses.

Drying is often a bottleneck and should have ample capacity provided. The flame should never be permitted to come in contact with the material to be dried.

Screening should be done at the end of the dryer and sufficient capacity provided.

The product should be cooled below 120°F. before going to storage.

Grades containing more than 300 pounds of ammonium nitrate should be coated with diatomaceous earth.★★

JAPANESE SYSTEMIC

(*From Page* 27)

Fussol, is a 10% liquid formulation of monofluoro acetamide. It can also be formulated as a liquid powder. The active ingredient, monofluoro acetamide is a white crystalline solid with a melting point of 105°C,—is tasteless and odorless,—soluble in water and alcohol, and insoluble in ether and petroleum. Fussol can be mixed safely with most standard pesticides, except strongly alkaline formulations, including lime, rosin mixture, etc. Rates suggested for application are:

Pest	Dosage qt./100 gal.	Dilutions
Scales	2.0 - 4.0	x 100 - 200
Aphids	0.7 - 1.0	x 400 - 600
Mites	2.0 - 4.0	x 100 - 200

Pests controlled by the chemical are: citrus ruby scale, arrowhead scale, mealy bugs, citrus aphids, European red mite, Citrus red mite and other sucking insects.★★

AQUATIC LIFE

(*From Page* 42

weighed carefully the economic benefits of controlling or eradicating serious insect pests against other values. Several of the fish kills reported recently have resulted from carelessness in application. Steps should be taken to prevent such situations, but occasional minor and temporary losses are to be expected in large-scale operations. Persons opposed to spraying because of damage to fish have failed to produce convincing evidence to substantiate broad claims of fish losses. It is the duty of all concerned with large scale control operations not only to know what is taking place in the field at the time of treatment and afterwards, but also to report fish losses, if any, to the newspapers and later in scientific journals. However, to maintain the proper perspective, it would be only fair to point out that millions of acres in this county have been treated successfully to control or annihilate dangerous insect pests each year without substantial damage to other insects.

(*Concluded next month*)

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Agrico Forms Two Divisions

The American Agricultural Chemical Co., New York, has established two additional regional sales divisions. The company's former Knoxville division now is the south central sales division and is managed by E. B. Brown.

Jukes Resigns Cyanamid Post

Dr. Thomas H. Jukes has resigned his post as director of research for the American Cyanamid Co.'s agricultural division to become vice president in charge of research for Nutrilite Products, Inc., Buena Park, Calif.

ZONOLITE VERMICULITE —a free-flowing, highly absorptive, inorganic, lightweight carrier for any type chemical. Low density. Cuts carrier costs. Formulates without caking or balling up. Technical information and assistance to help you work out new formulae on confidential basis. Also working samples, prices. Dependable service and supply from over 40 ideally located Zonolite plants.
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THE HEADQUARTERS and sales offices of the Panogen Co., agricultural chemical division of the Morton Chemical Co., have moved from Ringwood, Ill., to Chicago.

AC

WILLIAM R. RINELLI has been named general manager of the Chemical Products Division of the Ansul Chemical Co., Marinette, Wisc.

TVA DEMOS

(*From Page* 26)

Potassium hydroxide is being used with superphosphoric in at least one commercial plant, and probably is being used with orthophosphoric acid in a few others. Some use of by-product potassium carbonate as a means of reducing formulation cost has been reported. The potassium carbonate should give the same solubilities as obtained with potassium hydroxide.

Wet Process Acid for Liquids

INTRODUCING the discussion on use of wet process phosphoric acid for production of liquid mixed fertilizers, W. C. Scott, Jr., Process Engineering Branch, TVA, reported that about 63% of the total production of phosphoric acid for 1958 (equivalent to almost 3 million tons of acid containing 54% P_2O_5) was made by the wet process. The interest in wet process acid for liquid fertilizers is primarily a matter of economics, since in most areas wet process acid is generally cheaper than the furnace acid by about $0.20 per unit of P_2O_5. As is well recognized, however, the major drawback to its use is the presence of impurities in the acid. They precipitate when the acid is ammoniated, and the precipitate settles in storage tanks, tending to clog pipes and spray nozzles. The

precipitated impurities also tie up phosphate, the amount depending on the original content of precipitating cations in the acid. This precipitate has in some cases tied up as much as 18 per cent of the total P_2O_5 in the acid, so it cannot be filtered out and discarded without losing almost all of the economic advantage gained by using the cheaper acid.

J. A. Wilbanks discussed one means of overcoming the impurities; by sequestration of the impurities (and consequent prevention of precipitation) with superphosphoric acid or with ammoniated products of this acid, such as 11-33-0 solution. Tests conducted along these lines indicated that to obtain liquid products that remain clear during storage (7 days at 28° to 32°F, or 30 days at room temperature), a minimum of 20% of the P_2O_5 as sequestrant is required. Less sequestrant was necessary when it was added either before or during ammoniation rather than after. As little as 10 per cent of the P_2O_5 in the form of sequestrant was sufficient to maintain clear liquids for one or two days at room temperature, and 15 per cent maintained clear liquids for 7 days. Mr. Wilbanks reported that products containing 30 per cent or more of the P_2O_5 as sequestrant were still clear liquids after storage for as long as a year at room temperature; however, the minimum amount of sequestrant required for such long storage was not determined.

Several companies are now using superphosphoric acid or 11-33-0 solution as a sequestrant, with wet process acid, advised Mr. Wilbanks. In one instance, superphosphoric acid has been used for a full season to supply about 40 per cent of the P_2O_5; satisfactory operation was obtained.

TVA studies in which liquid fertilizers essentially clear of solids were made from highly concentrated wet-process acid, were reviewed by M. R. Siegel. The absence of precipitated soils in the liquid fertilizers was due to the self sequestering property of the acid which resulted from the presence of non-ortho P_2O_5. The non-ortho P_2O_5 was formed during the concentration step.

In this work, commercial wet process acid (51 to 53% P_2O_5) was concentrated by evaporation at atmospheric pressures. The process is still in the early stages of study, advised Mr. Siegel, and economical ways of carrying out the concentration are being considered.

Suspension of Precipitated Impurities

A SUSPENSION technique for using wet-process phosphoric acid in production of liquid fertilizers is also being studied at TVA, and was discussed at the Conference by J. M. Stinson. Preliminary work indicated that the impurities in acid precipitate in such finely divided form that they would not be likely to clog application equipment. It is only on standing for several days that settling tends to occur – the degree depends on several factors—and this settled layer becomes so dense or viscous that the product appears unsuitable for pumping or spraying.

From the preliminary work,—it would seem that use of wet-process acid would be feasible without any particular attention to neutralization, if the product is applied to the soil immediately after it is prepared. As a matter of fact, several producers are using the process on just this basis at the present time.

TVA, however, is continuing studies aimed at making a product which it will be possible to pump and spray without difficulty even after standing. Small scale tests thus far have indicated that use of a small amount (1 to 2%) of an attapulgite-type clay* improves stability of the suspensions.

Thus far, suspensions have been produced which had acceptable flow properties after standing for either one week at temperatures of 28 to 32°F, or for a month at room temperatures. Grades such as 8-24-0, 6-18-6, 7-14-7, and 7-7-7 were produced. All of these could be pumped without difficulty after the one-month storage period, either with a rotary vane-type positive displacement pump or a centrifugal pump. The suspensions were not disturbed during storage, and were pumped from the bottom of the container so that initial flow was from the thicker portion of the suspension.

Another line of investigation using wet-process acid was reported by H. K. Walters, who reviewed salt-suspension fertilizers, as a means of increasing the grade of liquid fertilizers. The products are made in the usual way, but the amount of water is reduced so that salting out occurs on cooling. The crystallized salts are kept in suspension by use of a suspending agent or other means for producing a stable suspension.

In small scale tests, clay was found to be an effective suspending agent. Only a small amount is required. Two types of clay were tested, a bentonite and an attapulgite*. To get the maximum suspending effect, it is necessary to disperse the clay thoroughly before adding it to the liquid fertilizer.

The clay additive not only stabilizes the suspension and minimizes settling, but also has an inhibiting effect on growth of the salt crystals in suspension. Although the products appeared satisfactory in the small scale tests, Mr. Walters cautioned that several factors have not been investigated as yet, which might have a bearing on distribution in field application equipment. Further work along this line is in progress, and emphasis is being placed on wet process acid.

A concluding talk was a report on the "Factors Involved in Handling Liquid Fertilizers", by C. M. Hansen, Michigan State University. A full review will appear shortly in *Agricultural Chemicals*.

Next month, part two of Agricultural Chemicals' report on the TVA Pilot Plant Demonstration will review the discussions on nitrogen loss, and the production of high and low nitrogen granular fertilizers.★★

*A colloidal clay, Attagel®, is the commercial product offered by Minerals & Chemical Corp., Menlo Park, N. J.

INDEX to ADVERTISERS

TALE ENDS

THE threat to agricultural insecticides embodied in the proposed Illinois legislation on hazardous substances seems over. At hearings held on the bill reported in these pages last month (S. 911 and H.B. 1461) it was indicated that these measures would be amended so that they would not apply to economic poisons registered under the Federal Insecticide, Fungicide and Rodenticide Act.

AC

Another source of potash on the American continent, south of Moab, Utah, may eventually be worked commercially. Delhi-Taylor Oil Corp. of Dallas, Tex., is reported to be "reasonably close" to completing arrangements with another concern in the fertilizer raw material field to develop its potash reserves at Can Creek Anticline. In an interview recently with the Salt Lake City Tribune, C. H. Hobbs, secretary of Delhi-Taylor, indicated that a major move would probably be made to get this new potash project under way some time in 1960.

Spencer Chemical reports that it is "in the final field testing stage" of a new herbicide specifically designed for control of wild oats. With 30 million acres of wheat land in Canada and the U. S. sufficiently infested to make use of such a herbicide desirable, and another 60 million acres where the problem could become more acute than it already is, Spencer's annual report predicts that a substantial market "could develop very rapidly" for its new wild oat herbicide.

AC

An "obituary" for soil conditioners is carried in the June, 1959, issue of *Consumer Bulletin*. Recalling the virtual disappearance of these "miracle products" from the agricultural market after quite a vogue during the early fifties, the article suggests that a review of their history "may help to keep many a garden lover and lawn tender from going overboard on the next big and equally improbable promotion." Soil conditioners foundered on the fact that their cost was simply prohibitive for large scale use.

AC

Three new movies made their debuts at N.P.F.I.'s annual convention at the Greenbrier last month. International Minerals showed "Out of the Earth", a twenty minute color film picturing production of fertilizer raw materials at IMC's plants at Bonnie and Bartow, Fla. Du Pont exhibited "Greener Pastures", an educational movie which emphasized the value of urea for supplemental nitrogen applications to increase agricultural yields. It was previewed for the press at a luncheon complete with green cocktails. Finally, N.P.F.I.'s own film, "Cash in on Grass" had its premier showing at the convention. Prints of all three films are available for showing before local groups.

AC

This monument to the boll weevil stands in Enterprise, Ala. Actually it celebrates the peanut almost as much as the boll weevil, for the area's fame as the "Peanut Capital of the World" stems from the fact that devastation of the cotton crop by the boll weevil forced Alabama farmers to grow other crops, and led to today's agricultural diversification. In gratification, residents of Enterprise raised this monument to the boll weevil some 40 years ago.

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